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Vol. IV CHICAGO, OCTOBER, 1910 No. 4

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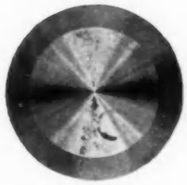

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SERVICE AND THE INCOMING CALL.

TELEPHONE service is always measured by the outgoing call. Even for unlimited service, which is not measured at all, this holds good; for all service is practically unlimited as to incoming calls. This condition is peculiar to the telephone business. It has no anology in any other public utility; for in no other service of the people are patrons dependent primarily upon their own interrelations and only secondarily upon the serving company. For this reason too, every outgoing call is an incoming call upon some other line; which very obvious fact we are quite apt to forget in making comparisons of service.

Some time ago a rather ponderous and wholly theoretical writer in a German technical paper argued that the recipient of a telephoned message should pay some part of its cost of transmission, since in the aggregate the incoming calls are quite as beneficial to the subscriber as his outgoing calls. Such a system would be beautiful if it were possible. The fact that it is not possible is responsible for considerable intricacy in the calculation of real service value.

A subscriber's use of his telephone for outgoing calls may be no measure at all of the value of his service. A retail storekeeper, for example, may have but three or four outgoing calls per day; yet a good part of his business may come to his store by telephone. It is to his advantage to have measured service, and with a low guaranteed number of calls at that. Yet it is also to his advantage to have his customers supplied with the cheapest possible service, that they may be induced to use the telephone freely in ordering of him. Such a subscriber would be foolish to vote for a universal measured service on the theory that it would tend to reduce the cost of his few calls.

This retail storekeeper gets his service very cheap—altogether too cheap, considering the actual use of his line. He transacts as much business by telephone, perhaps, as the small wholesaler, who makes a point of soliciting business over the wire. The wholesaler's calls, however, may be mostly outgoing, for which he has to pay by way of a higher class of service—probably unlimited.

Of course the low comparative cost of the retailer's service in the example given does not affect the operating company. All the calls over his line are paid for by some one if not by him. As a matter of fact a "free" telephone, one which of itself brings no revenue whatever to the company, still is a source

of some return by reason of its incoming calls, all of which, we may presume, are paid for at some point.

The five-cent prepayment stations, the cheapest form of service in most large cities, are frequently unprofitable to their operating companies because of their low guaranteed-call rate. Yet in the aggregate the vast number of outgoing calls from these stations constitute incoming calls on other, perhaps more profitable lines; all of which must be taken care of, to the increase of business in general. On the other hand, a considerable number of the cheap service stations are subscribed for solely for their incoming-call value, no attempt being made to meet the guarantee as to actual use of the instrument.

All this is merely for the purpose of pointing out that the profits of telephone operating is never a matter of individual station profits. The interdependency of all telephone stations transfers the burden of profit-making from one to the other most promiscuously. To use a homely formula, A is paying for B's telephone a good part of the time.

In appraisals of telephone properties for the adjustment of rates, which proceedings are becoming rather common of late, it is generally decided, on the strength of the figures, to increase certain rates to make them profitable, and to reduce certain other rates to make their profits reasonable. This particular kind of adjustment is not always judicious. The first consideration must always be the value of a certain service to its users, whether its rate be profitable to the company or not. If this rule is followed, the aggregate returns will inevitably show profit; for, as already explained, what one does not pay for another will.

Observe the probable effect of raising the rate of the present five-cent residence station to six cents, as has been suggested in the Chicago investigation. On a guarantee-call basis, this service would at once become profitable. But the ultimate reduction in the number of outgoing calls from these lines would make other telephones, already profitable, less valuable to their subscribers because of the reduction of their incoming calls. The result would be detrimental to the whole city system. Observe, also, the effect of reducing the present profitable rate on the measured service single-line business station. The presumable increase in outgoing calls from these stations, and the presumable increase in number of such stations, would produce an added load of incoming calls on the already overburdened and unprofitable flat rate lines, rendering them still less profitable.

The adjustment of telephone rates for a whole system is largely automatic. The day may come when, on a flat rate basis, some toll is taken of the incoming calls in the adjustment of equitable charges. Until it does, only experience can dictate the proper division of rates for different classes of service, and only good management can make the gross business profitable regardless of the emoluments from individual stations or classifications.

CONDITIONS OF TELEGRAPH TRANSMISSION.

IN this issue we publish the first installment of "A Study in Telegraphic Transmission," by Frank F. Fowle. This study was undertaken by Mr. Fowle as the basis for a comprehensive report on the comparative values of different line materials now in use, and his investigation of the subject was exhaustive. It is without doubt the most complete analysis of telegraph transmission conditions ever attempted.

The report is quite voluminous, and will run through several numbers of Telephone Engineer. In this connection, while it will be our endeavor to hold individual installments to a size calculated to avoid being burdensome to the casual reader, we regard the data furnished as of sufficient importance to engineers to justify a moderate extension.

Although the efficiency of telegraph transmission is absolutely dependent upon the means directly employed in the transmission process, probably this particular phase of telegraphics has received less expert attention than any other. At any rate, the general promulgation of scientific data on the subject has been comparatively slight. The fact that the measurements and calculations involved are too difficult to be undertaken until the exigencies of some specific case require them, has operated to prevent their becoming common property.

In this case we must thank the investigating spirit of a maker of transmission wire for the willingness to afford a hypothetical specific case of sufficient exigency to demand the most exhaustive effort of the consulting engineer, as well as for the willingness to disseminate this valuable information to all who care to read it. There are many who, realizing the labor involved in arriving at the conclusions set down, will give Mr. Fowle's study its true value.

A MATTER OF INTERCONNECTION.

UNITED STATES Consul Walter C. Hamm, at Hull, England, recently sent a report on the apparently successful operation of the municipal telephone exchange at Hull. It was stated that the city began its municipal operation of the telephone by adopting a schedule of rates which cut the previous charges of the National Telephone Company's system nearly in half. It has maintained these rates and so compelled the National system to reduce its rates to the same basis. In this way it has saved the telephone users of Hull a sum larger than the original cost of constructing the system. The following table of rates shows at what a moderate cost service is furnished:

Unlimited number of calls, business place	$30.65
Unlimited number of calls, residence	24.33
Five-party line, covering 720 calls	14.59
Unlimited number of calls, residence, two-party line	19.46
One thousand calls, exclusive line	24.33

In his report Consul Hamm, however, omitted the important fact that the National Telephone Company has three times the number of telephones in Hull that the municipal system has, and that the municipal system enjoys free interconnection with the National system; which privilege it obtained by virtue of its power to force removal of the National's underground plant.

Extended comment on the situation is unnecessary. The Hull municipal system is in the position of a single exchange, in a city of several exchanges, empowered to base its rates on the whole city system, keep all it gets, and pay expenses only on its own operation. Incidentally it affords an interesting example of the value of interconnection between adjacent systems; for without such interconnection the Hull municipal system could not survive.

SOUND TRANSMISSION.

THE distortion of different sounds in telephonic transmission is always an interesting subject. A comprehensive analysis of "Telephonic Intelligibility," by George N. Campbell, was published in TELEPHONE ENGINEER for April, 1910. Now the *Transmitter*, of Denver, attacks the problem with a dissection of the alphabet, the sounds, of course, being examined for their vocal, rather than their telephonic structure. Here is the result of the study:

a—sound.
b—very little sound until followed by a vowel.
c—practically no sound.
d—very little more than b.
e—sound.
f—purely breath; no sound.
g—some sound, but very guttural.
h—purely breath.
i—sound.
j—some sound, but very guttural.
k—practically no sound.
l—little sound (formed by a tip of tongue being placed high against the roof of the mouth, the sound coming only past the sides of the tongue.)
m—humming sound; nasal.
n—sound, but very nasal.
o—sound.
p—purely breath.
q—purely breath.
r—the trill carries sound, and "r" is sometimes called a semi-vowel on this account. Other uses of "r" carry very little sound.
s—hiss, but carries very little vocal sound.
t—purely breath.
u—sound.
v—more sound than "f," but muffled.
W—no sound, except as a combination of "oo" and "a" ("oo," "a," "z"—"was"). "w" compels heavy breath action when followed by "h," as in "where."
x—combination of "k" and "s" or the sound of "z."
y—sound, or rather a combination of "e" and "u:" as, "e," "u," "ok"—"yoke." "y" also takes the sound of "e" or "i" at times.
z—like "s," has but little sound.

As an example, "a" in *Kate* or *father* carries the sound that distinguishes the "K" or the "f." In fact, neither initial consonant in these examples carries any sound at all until the vowel is sounded. The vowel, in compelling an open mouth and throat, gives free passage for the vibration of the vocal cords. The consonant, on the contrary, is produced either with closed lips or cleaved tongue, or is a mere exhalation of the breath. Most consonant sounds do not actuate the vocal cords at all.

The result is that we rely upon vowel sounds far more than we realize in constructing intelligible speech. Mr. Campbell has already referred, in the article mentioned, to the telephonic confusion between "f" and "s," "m" and "n," etc. In many cases it is our sense of fitness, rather than our ears, that distinguishes between the two possibilities in the sound we hear. These conditions are true even in a *vis-a-vis* conversation. Telephonically difficulties arise because that sense of fitness is less active, and we rely more strongly upon the unsupported sound.

Our language we must accept for what it is, even if a few of its sounds are not entirely suitable for telephonic transmission. The only lesson in this study is to encourage a clear enunciation on the part of operators and other employees, and the public, as far as possible. A well-rounded vocalization of vowel sounds and a very careful execution of the consonant structures are really necessary to distinct telephonic utterance.

UNDERGROUND WORK.

THE constantly increasing demand that public service wires be placed underground has found a good many telephone managers unprepared to meet it, both as to finances and knowledge of the requirements. In many towns the subject is only beginning to attract attention, and the local exchange manager has never devoted any time to its consideration. But there is no longer any question as to the advisability of burying all transmission wires in the heart of a town of any size, even as a matter of ultimate economy, to say nothing of the augmenting objections to overhead wiring and poles on the part of property holders and city officials.

Many public service managers will be forced next spring to give attention for the first time to this growing sentiment. It behooves them to devote some little time this winter to a study of the requirements of the situation. Even a casual study of methods and costs may reveal that the process of burying wires is not so expensive as they had deemed it, when the benefits to the company are considered. The elimination of sleet storm damage alone is likely to prove a tremendous factor in economical maintenance, as the coming winter may demonstrate to more than one doubting "Missourian."

A paper read at the fifteenth annual convention of the International Association of Municipal Electricians by J. B. Yeakle, Baltimore, while it does not touch upon the question of cost, lays down some principles which should be known to every telephone manager. It will give them at least a clear idea of how the work should be done, and enable them to check the methods of a contractor against their acquired knowledge. For this reason we quote the following from Mr. Yeakle's paper:

A proper knowledge of underground construction means some information regarding strength and ductility of armor, insulation and conductivity of conductors, proper means of drawing, splicing of joints, preparation of the metal and fluxes used to make joints water tight and other factors that are immediately concerned in underground work.

The question of strength and flexibility of the cable armor leads to a proper care in selecting material where other work is being considered and is a help in establishing a system that will lead to the best results in every department.

The lead armor common to all underground cable is strengthened by the addition of a small percentage of tin. Its flexibility is not reduced but its tendency to part from excessive strain is lessened.

Lubricating the armor by the application of soapstone, tallow or common oil, prevents friction by which the protecting lead might suffer.

Cleaning the armor and sleeve, proper temperature of the lead to be used in wiping the joint, the quality of the solder are also important.

Careful handling of the molten solder, heating apparatus (to avoid injury to the men working in or around the manhole) and absolute cleanliness of all material used in making a splice.

All tools used in cable work should be set aside for that particular service and not used indiscriminately for line work, except, of course, shovels, digging bars and similar equipment, which belong to the inventory of construction and repairs.

The type and number of manholes is a factor in the lay-out to be determined after the territory has been selected and the accommodations to be provided. Concrete is becoming popular for this purpose and promises to give permanent and reliable service. The frames are easily prepared from inexpensive material and to one familiar with carpenter's tools, the construction will not be a difficult undertaking.

In very low places or where water is liable to settle, provision for drainage is important. Ordinarily, a small ship's pump will be sufficient to clear the manhole when necessary to enter.

Ventilation must not be overlooked. The practice for some time has not included special vents except in extraordinary cases.

The inner cover, at one time considered essential, has, for several reasons, been abandoned. They were found not to be

essential. The interference from unauthorized entrance was rarely, if ever, a matter of concern and beginning with neglect to properly fasten them, they have finally been dispensed with.

The top cover is provided with vent holes near the edge where it lies in the supporting rim of the dome and although some dirt falls through, monthly inspection, even on streets of considerable traffic, is sufficient to keep them in good condition.

The person in charge should inform himself of the points most liable to the presence of gas and use the utmost care in entering manholes. In such places an exhaust pump should be in constant use while working in affected manholes, and no one should be allowed to go into them until after they have been open for ten or fifteen minutes and found to be clear of dangerous gases. Use of open lights for testing or working in manholes must be prohibited.

The presentation of a type of manhole is not included in this paper. Reliable maps of the territory involved should be the foundation of an underground system. Test stations should be established at convenient points and observations made and recorded from the beginning of the drawing of the conductors. The testing device of Mr. Farrand will be found useful in connection with the voltmeter and milliammeter for keeping a close watch on the conductors and a speedy method of locating faults, especially to one who has the advantage of the early records suggested.

Nature of soil and the results of decomposition as it affects the materials of which the armor or conduits are composed should be a feature of the preliminary survey and subsequent information obtained from experience.

Electrolytic conditions are to be studied. Proximity of currents of abnormal strength. Their source and direction. The capacity of the return, whether track or bond wire. Frequent inspection to determine the polarity of the cable armor as compared with that of the leakage from the conductor likely to impair its efficiency.

For conductors, soft drawn copper wire is the standard. The insulation will depend on local conditions. Where only low voltages are to be provided for, the character of the compound and its diameter need not approximate the grade necessary where the cable is liable to interference from high potentials in its vicinity. A slight fracture of the armor in which rubber insulation is employed will give time for correction of the fault before it becomes obstructive. Paper is liable to cross or ground a loop, if armor is punctured or broken, before the fault can be reached.

BOSTON RATES BEING REGULATED.

THE Massachusetts Commission has prescribed to the New England Telephone and Telegraph Company, a new basis of rate-making, worked out by Prof. D. C. Jackson and his staff. The new system will be applied to the Boston and suburban district, and is a scientific apportionment of the factors of plant investment, running costs and interest charges to each class of service used in that district.

In its report to the company the commission says:

The preliminary studies indicated that a reduction of from $300,000 to $400,000 could be made in the net yearly income of your company from the metropolitan and suburban districts with entire fairness to your company and without impairing the efficiency of the service. This would amount to a horizontal reduction of only a small percentage per telephone if applied upon each individual rate.

The traffic study showed conclusively that the rates per call collected from individual subscribers in different classes varied from ten cents per call to less than one cent per call, and certain of the larger users securing calls at a cost of less than half a cent. Such variation is manifestly unjust and inequitable. The gross collections of your company for exchange service in the entire metropolitan and suburban district was slightly less than three and one-half cents for each complete call.

It is plain, therefore, that the larger users having unlimited rates covering the whole of the suburban area, who pay from one-half a cent to two cents per call, are paying less than cost, and this has to be made up by the smaller users paying from six to ten cents per call. This latter collection was necessary to enable your company to secure an adequate revenue from the subscribers in the district as a whole, but was necessary only because a proportionately few subscribers obtained their service at this extremely low and unprofitable rate, sometimes so low that it does not even pay the wages of the operator, to say nothing of the much larger expenses required for interest, maintenance, taxes etc. The evident injustice of this condition the commission has sought to abate.

The commission therefore instructed its experts to report a schedule of rates which would not only reduce the net yearly income in the metropolitan and suburban district from $300,000 to $400,000 yearly, but which would be founded upon a rate for small users of a maximum charge of five cents a message for a minimum number of guaranteed calls.

This resulted in the experts reporting a recommendation for the establishment of zones and a new schedule of rates therein as the only practicable way by which rates can be secured to this district which are fair, proportionate and equitable.

The establishment of zones seems the only practicable means of securing the lowest possible rates for the moderate user of calls, who only needs a limited territory. It is the only possible way by which any unlimited telephone service can properly be retained and an adequate revenue secured from the district without charging the loss to the smaller users, or by which the maximum rate per call can be reduced to five cents.

The toll charges recommended cover as long a distance at as low a rate as seems, even in such a densely populated district, compatible with securing for the company an adequate revenue.

It occurs to us that a consideration of some of the factors of service mentioned in another editorial, "Service and the Incoming Call," might have affected the commission's decision as related in the third paragraph of its findings.

THE "TELEPHONE ADDRESS."

A SUGGESTION to use the telephone number in lieu of the street address in directing cablegrams or telegrams emanates from the fertile brain of Mr. Herbert Laws Webb. The notion is interesting, although it has no particular bearing on the telephone, meaning merely the adoption of the shorter of two possible distinguishing codes. Of course, it may suggest the use of the telephone in delivering the message to its ultimate destination; but as that is not uncommon practice at present, the advantage there is small. The shortening of the telegraphic address would, no doubt, be a great advantage. Difficulty would arise, however, from the fact that individuals and even business houses generally keep no record of the telephone numbers of their correspondents in other cities, whereas they generally know the street number; and it obviously would be impossible to file copies of all the world's telephone directories.

Mr. Webb's suggestion has the merit of novelty and is interesting, but we fear it is impracticable.

JOINT POLES TABOOED.

REGARDING joint use of poles the committee on overhead construction of the Pennsylvania Electrical Association recommends that the joint use of poles be avoided wherever possible and that every company endeavor to maintain a clear right-of-way of its own, making all extensions on its own poles and avoiding the atachment of poles of the other company. This, in the opinion of the committee, will without doubt furnish the most satisfactory operating conditions for both companies. The committee then briefly states a few of the important points brought out, with the recommendation that where joint agreements are found necessary the specifications of the N. E. L. A. be carefully studied.

Telephone and Telegraph in Chicago

By James B. Crippen

THE telephone and telegraph have always been thought of as allied institutions, both being concerned with the transmission of messages by electrical means; but until recently they have never acted very extensively in practical co-operation, the one seldom assisting the other in the transmission of a single message. In Chicago, however, a system of complementary operation was inaugurated about a year ago and it is working with pronounced success. The object is to facilitate the conveyance of the message between the subscriber and the telegraph office, or vice versa, the telephone performing the function of the usual messenger boy. Any person who is a telephone subscriber is allowed the privilege of calling up the main telegraph office and there giving his message, which will be immediately sent, a bill for the charge being rendered at a later date. Thus every telephone may be made the terminus of a telegraph line. As a saver of time and trouble the system has only to be described to be appreciated.

To receive the great number of messages constantly coming in under this arrangement, the Western Union Telegraph Company has established an elaborate telephone department in its main office. It occupies a gallery at one end of the main operating room, but is cut off from the noise of the telegraph instruments by a sound-proof partition. Here a private branch exchange with a two-position switchboard containing thirty incoming trunk lines is installed. Through this switchboard the ordinary telephone business of the telegraph company is conducted in the ordinary manner; but for the handling of telegrams special arrangements have been provided.

Not far from the switchboard are two recording tables, at each of which sit ten telephone operators, five to a side. In front of each operator is a miniature lamp signal system, multipled throughout, so that any incoming call flashes a white light to all operators, while a red lamp indicates any outgoing line which may be in use. All incoming calls pass through the

Telephone Room of the Western Union Telegraph Company, Chicago.

switchboard, and if the call is for general office business, the switchboard operator makes the desired connection. If the call, however, is from a party who wishes to send a telegram, the operator connects with the recording tables. Instantly a white signal is flashed at each of the twenty positions, and the first unoccupied operator plugs in. This action extinguishes the other lights, so that all operators are apprized that the call is answered and the message is being taken. The message is taken word by word, and then repeated in its entirety to obviate as far as possible the chance for mistakes.

For the reverse process, namely, the delivery of telegrams, there are fifteen outgoing telephone lines running directly from the recording tables to the telephone company's exchange. This arrangement prevents congestion at the switchboard, and provides an equipment capable of receiving twenty messages and delivering fifteen, all at the same time. The number of messages delivered by telephone is greatly in excess of those received in that way, but the incoming equipment must be larger, because an average of three messages can be delivered in the time consumed in receiving one.

All telegraph messages arriving in Chicago go directly from the receiving instruments to the distributing table in the city lines department, where they are routed to a branch-office wire and dropped to the messenger delivery department; or in case the addressee is a telephone subscriber, his telephone number is written on the message, and it is sent immediately to the telephone room. The search for telephone numbers is made at the distributing table, so that the telephone operators are not delayed. Thousands of messages received daily are immeditely telephoned to the person addressed, and later, on request, may be delivered by messenger. The upshot of the system is that the city business is more and more concentrated in the main Chicago office, a very desirable consummation. The public is encouraged to send its messages direct to headquarters, instead of through the roundabout channel of the branch offices.

There are in the telephone department of the Chicago Western Union office something more than twenty employees, the department being in charge of a trained woman supervisor. The switchboard operators do nothing but make connections, while the operators at the recording tables receive and deliver telegrams only.

If other cities take to this system, the process of transmitting messages will become a chain of three links, the telephone at both ends and the telegraph in the middle.

International Electrotechnical Commission.

The *Electrician*, London, reports an unofficial conference of the International Electrotechnical Commission held at Brussels August 8 to 13. about 50 attending.

The conference was opened by Col. R. E. Crompton, C. B., after which Prof. Eric Gerard, of the Institute Montefiore, Liege, gave an address of welcome to the delegates and representatives, and said the commission was to be congratulated upon the success with which it was meeting in the various countries. He explained that the present conference was in no way official, but was intended as a preparation for the official meeting it was proposed to hold in Berlin next year. The Belgian committee, he said, offered a very hearty welcome to the representatives from the various countries, and trusted that the conference would fulfill its object and enable the commission to show practical proof of its utility. The conference, being unofficial, no definite resolutions would be come to; on the other hand, he hoped most useful propositions would emanate from the conference to be placed before the various electrotechnical committees.

The question of nomenclature was first considered. Dr. E. Budde, representing the German committee, put forward a list of about 80 terms. This aroused much discussion. It was fully recognized that the work already carried out by the British, French, Italian and other committees who had for the past year or two studied the question of an electrotechnical vocabulary, was of great value, and that the question of the vocabulary was one which was and would always form part of the work of the commission. At the same time, in order to facilitate progress, the conference decided to recommend to the various committees the idea underlying the proposal of the German committee, viz., to take a certain leading idea, for instance, an electric generator, and to describe its various parts, each committee being subsequently asked to give the term in French and English and in their own language for each particular part described. Each committee are to send their replies to the central office before March 1, 1911 ,and delegates from the British, French and German committees will meet before the following September in order to prepare a list of agreed definitions to be put before the commission at its next meeting.

The conference also suggested that the French and Belgian committees working together should be requested to undertake the preparation of the logical list of fundamental ideas in such a manner that one definition leads naturally to the next. These definitions will be gathered into groups, certain leading ideas being taken as the starting point for each group.

The French representatives next put forward certain principles in regard to the question of symbols. These proposals, which are of great importance, came in for much discussion, but finally it was agreed that the following five principles should be submitted for the consideration of the various electrotechnical committees: (1) That small letters be reserved for instantaneous values of electrical quantities varying with the time; (2) that capital letters be reserved for effective or constant values of electrical quantities; (3) that capital letters followed by the suffix "m" be reserved for the maximum values of periodical electrical quantities; (4) that capital script letters be reserved for magnetic quantities, constant or variable; (5) that capital script letters accompanied by the suffix "m" be reserved for the maximum values of magnetic quantities.

The conference also agreed to suggest the following eight symbols:

Electromotive force	E, e
Electrical quantity	Q, q
Inductance	I
Magnetic force	H
Magnetic flux density	B
Length	L, l
Mass	M, m
Time	T, t

The omission of a μ for permeability is noticeable. In view of proposals likely to be introduced at a later date, however, it was decided not to include permeability at the present stage especially as the use of μ for permeability is practically universal.

Underground Construction

By R. H. Williams

THE present year is breaking records for underground construction among the telephone companies of the west. There are two rather remarkable factors concerning this year's work in this line. One is that heretofore a large part of a year's underground construction work has been the building of new lines, new exchanges, and extensions. This year's underground work among telephone companies has been almost entirely the replacing of aerial lines by permanent underground cables. This has been due partly, of course, to the franchise conditions in a number of cities where ordinances requiring the displacement of street poles and wires are being enforced. A still larger percentage of the new underground work has been done voluntarily by telephone companies who are striving to cut down the large maintenance and depreciation costs of their aerial lines.

Underground Construction at Des Moines, Iowa.

Manhole Construction.

Laying Triangular Three-Duct Tile.

Lowering Conduit Into the Trench.

The second feature of this year's work is the permanency of construction which telephone engineers are insisting upon. It has been very noticeable to those who have been in a position to watch the work that quite generally, for the three years preceding this, the tendency has been to do underground work as cheaply as possible and neglect the future. This has been evidenced in several ways, by skimping the concrete, by cheapening the manhole construction, and by substituting for a permanent conduit some makeshift entailing a smaller initial expense, but so short-lived that cables cannot be withdrawn and replaced after ten years' time.

This year the telephone engineers are more generally insisting upon the best grade of conduit, and they are laying it to stand a century without depreciation.

Whether these two tendencies arise from the fact that engineers have learned from former experience that it pays to aim at permanency in construction, or whether this year's tendency is due to the better financial condition of telephone companies is hard to determine. It is probable that both are important factors, but it is certainly an encouraging condition to meet.

One company, which manufactures vitrified fire-clay conduit and gives all of its attention to this one special commodity, reports that it has supplied one hundred and thirty-eight different telephone companies with conduit since Jan. 1, 1910. These companies range all the way from Philadelphia on the east to Texas points on the south, and the Pacific coast on the west, and include four different companies in Canada.

The Progress of Work. Showing Laying of Tile, Cementing the Joints, and Completed Conduit.

The accompanying illustrations show some underground construction work done by the Mutual Telephone Company, at Des Moines, Iowa. This company has done a great deal of underground work and has the reputation

for doing an excellent class of such work at a minimum figure. This is very largely due to the initiative of the manager, Mr. Roy Walker, and serves to illustrate a point which is universally applicable.

A considerable part of the cost of underground construction is unnecessary. The best materials can be obtained, and yet the cost need not exceed that often expended by companies which obtain poor lasting qualities with cheap material. This saving will come very largely by arranging for a methodical handling and arrangement of laborers. A little thought on the part of the superintendent will bring about many time and labor saving devices, such as are shown in these illustrations. The conduit is lowered into the trench by means of wires so that the one workman in the trench can place the dowel pins and butt the joint without any loss of time or extra moving of the piece.

One man follows with a pail of neat cement and a brush, by means of which the burlap is thickly painted or plastered over the joint. The line is then ready for the concrete envelope. Just as much saving can be made in the other operations if they are closely watched by a systematic man.

Long Distance Development

By J. J. Carty*

ONE day—one hot day—more than thirty years ago, in this city, an old lady painfully toiled up the inevitable flights of stairs which led to the telephone office of those times. Out of breath, she sat down, and when she had recovered sufficiently to speak, she said she wanted to talk to Chicago. My colleagues of that time were all what I think the ethnologists would rank a little bit lower than the wild Indian. They—or perhaps I should say "we"—were the prototypes of those who are today fringing the edges of the plant, traffic and commercial departments. Well, these youngsters set up a great laugh; and indeed, the absurdity of the old lady's project could hardly be overstated, because at that time Salem was a long-distance line, Lowell sometimes worked, and Worcester was the limit,—that is, in every sense of the word.

The Lowell line was so unreliable that we had a telegraph operator there,—I think some of you may remembed him, Holden; he was a Vermont Yankee,—and when the talk was not possible, Holden pushed a message through by Morse. To those who remember the difficulties which the operators were then encountering in getting a message even to Salem, it is no wonder that the absurdity of the old lady's proposal was the cause of poorly suppressed merriment. She wanted to talk to her son in Chicago at a time when Salem, Lowell and Worcester were the uttermost long-distance frontiers. But I can remember that I explained to her that our wires had not yet been extended to Chicago, and that, after she had departed, I turned to the other operators and said that the day would come when we could talk to Chicago. My prophecy was received with what might be called—putting it mildly—vociferous discourtesy. Nevertheless, I remember very well the impression which that old lady's request made upon me; and I really did believe that, some day or other, in some way, no one knew how, we would be able to talk to Chicago.

A great many things have since happened, some of which I will relate; but there stands out in my mind, and if I were an artist and going to make pictures of these things, I would have the scene of the old lady wanting to talk to Chicago, the boy operators in the background; then a period of ten or twelve years would be supposed to elapse until the next scene arrived, and that would be at 18 Cortlandt street in New York; and there we had a most distinguished company centered around Alexander Graham Bell, on the day when he opened the New York-Chicago line and talked to the mayor of Chicago and, I think, to the governor of Illinois. Being present in that group—and the picture shows just the top of my head—I was thinking of the old lady that climbed upstairs at Boston and wanted to talk to Chicago. At that time my prediction seemed a wild one; it didn't seem to have any foundation in fact or in philosophy. And yet something or other in me told me that day that some day we would be surely able to talk to Chicago—and we did.

Now the moral of all that will presently appear when I make some other predictions,—when I tell some other predictions which I have made and which I have undertaken to make good and which I believe I will make good.

About a year ago, for the first time, I visited the Pacific coast. In common with all of the boys of the east, I had studied geography, seen pictures of the Sierra Nevada mountains, read my "Buffalo Bill," knew about the trappers and the overland trail, and of the old pioneer spirit of "Pike's Peak or bust." I went over that trail, not on the back of a mustang, but in a Pullman car. But in going over that route and in reading and rereading the history of that westward movement, inspired by the grandeur of Mr. Vail's ideal of universal service, I was seized with some of the old pioneer spirit. The railroad upon which I traveled was called the Union Pacific Railroad, and the fact that it was so called was suggestive to me. When I got to the Pacific coast, I stated to Mr. Bradley, our vice-president there,—realizing that we had no telephonic connections with the east—that I was "greatly impressed with the isolation of the rest of the country."

Upon taking leave of him to return east, he was very complimentary to me and my colleagues for some work we had done for him there, and at that I said that I thought that the trip had done me and our general interests more good than it had done him and his company. I was impressed with the fact that California—telephonically—was not in the Union. I was impressed with the fact that the Union Pacific Railroad was built for the purpose of tying that part of our country to the rest of the Union. That was

*Address before the Telephone Society of New England, Boston, Mass.

why the railroad was so called—Union Pacific. We were not one nation until California was admitted to the Union, until it was tied up by the railroad and the telegraph. Now, telephonically, we are not one nation until we are able to talk from New York or Boston to San Francisco; and the thing which I promised that I was going to undertake was nothing more or less than to go back and set to work, so far as it in me lay, all of our machinery and resources, to establish telephonic communication between the Atlantic and Pacific.

Well, now, having made this known, how to do it! And, by the way, when I say "I" accomplishing that result, I trust you will all understand I am speaking for the entire institution. I am speaking for my colleagues and my assistants and for you and all of us; and it is not by any means a matter of my own personal affairs, although I am directing it. So I came back and had a review of the state of the art with respect to the possibility of transmission of speech. And I think it would be interesting even if I must touch somewhat upon detail matter, to say a word about the state of the art.

This Worcester line, which was the limit, was made of iron, and it was a very large size. The difficulties growing out of such a construction I need not emphasize. Iron wire of all kinds was tried and failed. Copper, it was realized, was the material from which to make successful long-distance lines. But copper as then obtainable, would, on a day like today, for instance, slack out, and no matter how cold it got tomorrow, it would never get back; and a succession of hot days would bring the wire down to the ground, so that it made it very easy for the linemen to shake out the crosses. The story of the development of hard-drawn copper wire is an old one, and it has been often told.

Then the importance of the transmitter was realized, and very great improvements were made in the transmitter. But even with the best transmitters and with hard-drawn copper wire, the limits of speech transmission were reached. Then came the story of loaded wires, a very remarkable development, particularly in view of our early work. An inventor proposed to insert into the line a lot of magnets, having inductance, the very thing we had been laboring all our life to take out of the line and keep out. But he showed that if these magnets were placed in the line, or these inductance coils, to speak more accurately, placed in a particular part of the line, with proper regard to the wave length, their effect would be beneficial.

The result is that very, very great improvements have been made in overhead lines and in underground lines by the use of this loading invention. But the loading invention and the complexities of which it must form a part, had not yet been adjusted to each other. For instance, we were not able to load a No. 8 line. That is, the heavy copper wire upon which we would have to rely for our transcontinental work. It was not practicable to load such a line for the reason that a higher degree of insulation was needed under those conditions,—under the conditions where you used No. 8,—a higher degree of insulation was needed than when a No. 12 was used. I won't undertake to explain why that is the fact.

So one of the results of my California trip was to stir up the whole question of this matter of insulation, work upon which was proceeding, but very great pressure was put on. A review of the whole problem of insulation was made. It was found that in America glass insulators are the rule, but in other parts of the world porcelain insulators are the rule; and it was difficult to find from anybody why glass was used or why porcelain was used. A very exhaustive study covering not only experience in this country but in all other countries, has resulted in the development of a porcelain insulator which, when applied to loaded lines of No. 8 gauge, very largely removes the insulation difficulty. But it also appeared that there was difficulty at the bridle wire. The braid upon the bridle wire used in these lines in wet weather conducted the speech, so to speak, and then we had the problem of insulating the insulator. That was successfully accomplished. An experimental line was loaded between New York and Chicago, and in dry weather the degree of transmission was very remarkable; in wet weather it fell off. But with improved porcelain insulators, with the improved bridle wire insulator, and with an improved transmission method, the insulation on that line now, under the most unfavorable weather, is entirely satisfactory, so that we have accomplished the problem of successfully loading the No. 8 lines.

But that is only part. It has not been practicable to phantom the No. 8 lines. The coil—the induction coil used for that purpose—was good enough for the No. 12, but was insufficient for the No. 8, and the reason was that it was a coil through which we attempted to ring and talk; it was a compromise coil. We tried to please both sides, with the usual result, we did not please either. It was not a good talking coil. So we designed a coil that was good for talking and then developed a high-frequency ringing current. The result is a coil available for phantoming No. 8s, in which the losses are practically negligible. The bearing of this phantom work and of this loading will appear as I go on. It had not been possible to phantom loaded wires of any kind. We were obliged to choose between a loaded circuit or a phantom circuit. If we made a phantom circuit we could not load, and that was a state of affairs not to be tolerated. That has been tackled, and a method is now issuing which enables us to load phantom circuits or phantom loaded circuits. So there we have started in with No. 8s, that is, the big wires. We can load them, we can phantom them, we can phantom them loaded.

Now see what that accomplishes. Between New York and Chicago we will load two pairs of No. 8s. These will be phantomed. That work is going on. Between Omaha and Denver we are stringing two pairs of No. 8s. They are to be loaded and they are to be phantomed. Between Omaha and Chicago we have one pair of No. 8s that is to be loaded. See, then, the circuit that we can construct. From New York to Chicago a phantom circuit composed of two loaded 8s. That phantom circuit will be the equivalent of a pair of loaded 6s, and it will be got at at a trivial cost. We will make the company a present, so to speak, of a pair of loaded 6s between New York and Chicago. Then, between Chicago and Omaha, that phantom circuit will become a single circuit, but at Omaha again it will be connected to a phantom circuit, the loaded 8s to Denver, and over that circuit we expect to get a talk which will be practically commer-

cial and good, between New York City and Denver.

Now I dwelt somewhat at length upon this phantom proposition because of an early experience which Charles Herzig and myself had, and in which Gen. Sherwin has figured. At a very early date, before we could successfully talk over a single line or successfully have one pair of customers talking over a long-distance line, I was interested in trying to duplex the line, and as a result I devised a method whereby two metallic circuits might be used to make a third, or whereby one metallic circuit might be used for a telegraph line at the same time it was being used for talking purposes; and at that time it seemed to me a very great achievement. I felt rather corroborated in that point of view because Charlie agreed with me. Like all inventors, I was afraid somebody would steal my invention, but unlike most of them, I was willing to trust somebody. So Ed. Backus, who is now dead, and Charlie Herzig were in the secret.

The coils I made were necessarily to be seen by anybody about, so we put on them a whole lot of fake binding posts, with a lot of queer wires running around, so that no outsiders would ever find out about them. But Charlie and I had a secret code, and we knew which was the real circuit. So I sent Ed. Backus down to Providence; Charlie and I went up in the tower,—the place where the wires used to come in we called the tower in those days—and sure enough, you could talk on the metallic circuit line, while telegraphing by means of the metallic circuit and the ground, or we could talk on the metallic circuit and also talk over these same two wires using the ground. None of us knew Morse then, but I suppose we must all learn it now. To test the telegraphic features of the circuit we made a lot of dots and dashes, none of which could be heard on the telephone circuit, being used simultaneously. So I really thought I had made one of the greatest discoveries of the age, and I filed my application for a patent.

Everything went well until the patent was ready to issue, and then the patent office woke up and gave me a reference to a fellow named Jacob over in England, and he came dangerously near covering all that I had invented. You can well imagine my feeling of disappointment. But it was found that, notwithstanding that Jacob had preceded me on some features of this work, and that he did good and earlier work of his own, there was much which he had left undone. In the first place, a circuit made up according to this phantom method would be impracticable in many cases unless it were transposed. So I devised a system whereby not only the individual wires of the component pairs were transposed, but the two pairs themselves changed places in accordance with a rule I laid down; and I got a good patent on that, and it expired long before anybody began to use it. I not only carried out the transposition idea as applied to open wires, but I also worked out a plan for making a phantom cable which, in its essential ideas, forms part of the continental project which I have described.

Furthermore, I conceived a scheme of having, let us say, a system of four wires running between Boston and Providence, two circuits; then another from Providence to New London, New London to New Haven, New London to Bridgeport,—a circuit which would permit a conversation between two people—one in New York and one in Boston—and at the same time the wires over which they were talking being used by probably a dozen or more other people at the same time on the intermediate sections, without interference with each other. Nothing came of that circuit. But it is exceedingly interesting to me to recall that this circuit I have just outlined between New York and Chicago, Chicago and Omaha, Omaha and Denver embodies exactly that idea. That patent has also expired. But as we are somewhat reminiscent and talking about old times, it is really of very great interest to me, taking into account all of the surrounding circumstances, that that early work in which Charlie and I kept our secrets so well, at last came into practical use.

English Telephone Rates

Among a mass of interesting data on public utilities in London, forwarded to Washington by Consul General John L. Griffiths, are some figures on English telephone rates.

Mr. Griffiths informs us that the rates of subscription (including one telephone at the subscriber's premises) are as follows:

Ordinary message-rate service: (1) Charges for connection with any exchange in the county of London within two miles of the subscriber's premises, annual subscription, £5 ($24.32); message fees, two cents for each call to a subscriber on any exchange in the county of London, four cents for each call to a subscriber in any exchange outside the county of London. (2) Charges for connection with any exchange outside of the county of London, within two miles of the subscriber's premises, annual subscription, £4 ($19.46); message fees, two cents for each call to a subscriber on the same exchange, four cents for each call to a subscriber on any other exchange. The minimum yearly amount payable by each subscriber for message fees is $7.30.

The telephone trunk lines which connect the various telephone exchange areas throughout the kingdom are under the control of the postmaster-general and are worked by his officers. The trunk lines can be used by callers at post offices which are connected with the trunk telephone system, as well as by subscribers and callers using telephone exchanges. The fees for the use of the trunk lines are as follows: Up to 23 miles, six cents; 23 to 50 miles, twelve cents; 50 to 75 miles, eighteen cents; 75 to 100 miles, twenty-four cents; every additional 40 miles or fraction thereof, twelve cents.

The telegraph charge is twelve cents for the first twelve words, including the address, and one cent for every additional word. With the exception of words which are ordinarily written as one, or coupled by hyphens, no combination of words is counted as one word. Such abbreviations as "can't," "won't," "don't," are counted as single words. Figures are counted at the rate of five figures to a word; fractions according to the number of figures employed, the mark of division being counted as a figure. Thus, "½" counts as one word, "2¾" as one, "10978" as two. In groups of figures a stop or oblique stroke is counted as a figure. When words are underlined, or placed in parentheses, or within inverted commas, one extra word is charged for. One word each is also charged for the ordinary signs of punctuation ,if they are required to be transmitted.

Some Questions Answered

By H. A. Douglas

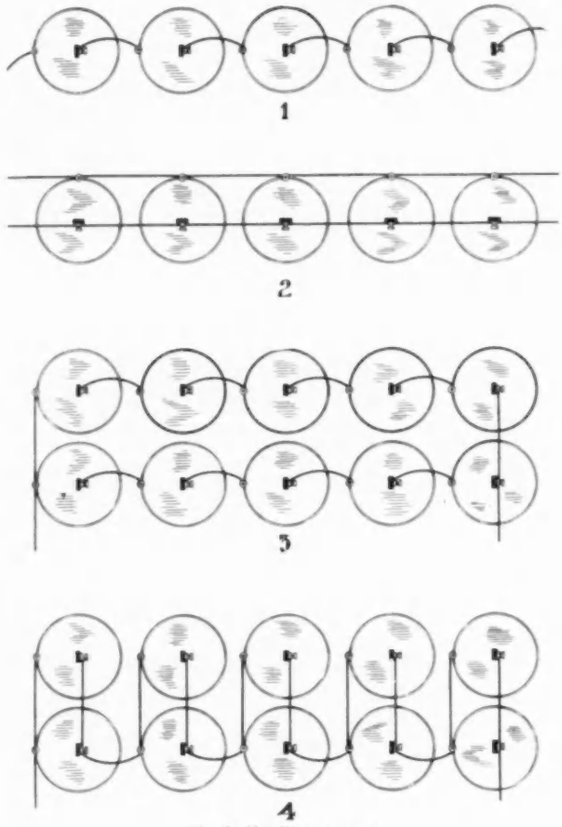
Will you kindly tell me through your query department the different ways of connecting batteries? I refer particularly to dry batteries connected in series and mutiple. Please tell me what the results should be for each one of the separate connections and why it is desirable to connect batteries in multiple.—E. C. H.

FIGURE 1 shows 5 cells of battery in series; new batteries connected in this manner should give about 9 volts and 15 to 20 amperes.

Fig. 2 shows 6 cells of battery in multiple; this circuit should give about 1½ volts and a considerably greater amperage than the six cells in series. This is due to the fact that each cell has a certain internal resistance, and it is well known that resistances connected in multiple decreases the total resistance in exact proportion to the number so connected.

Fig. 3 shows 10 cells of battery in multiple series. Connected thus we have the same voltage as in Fig. 1, about 9 volts, but owing to the multiple connection the amperage is increased to about 40 amperes, provided all of the batteries are in good condition.

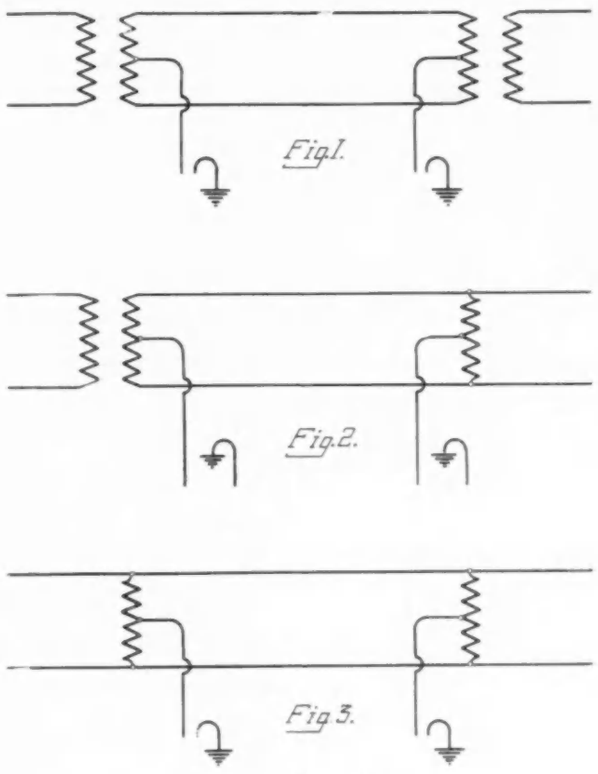
Fig. 4 shows 10 cells in compound series-multiple.



E. C. H., Figs. 1 to 4.

This circuit has a decided advantage over the multiple-series form of connection as may be seen by reference to the drawings. Suppose in Fig. 3 we have one poor cell. A poor cell always means a high internal resistance, so it is evident that the other five batteries connected in that bank or series must work through the high resistance of the poor cell. Should the cell be very bad, the resistance would be so high that we would get but very little current from that set of six batteries.

Now, referring to Fig. 4, if one of the cells in this circuit should be run down and of high resistance



C. C. B., Figs. 1 to 3.

or even disconnected entirely, it would have no effect on the other cells, although of course its loss would be noticed when a reading of the total battery was taken, due to the fact that the resistance of the entire circuit would be increased to one-half the internal resistance of one good cell.

By connecting batteries in series-multiple it is possible to use them much longer than in straight series. A considerable number of old cells connected in this manner may be used with good results until they are quite exhausted. It is desirable to test them occasionally and cut out the poorest of them.

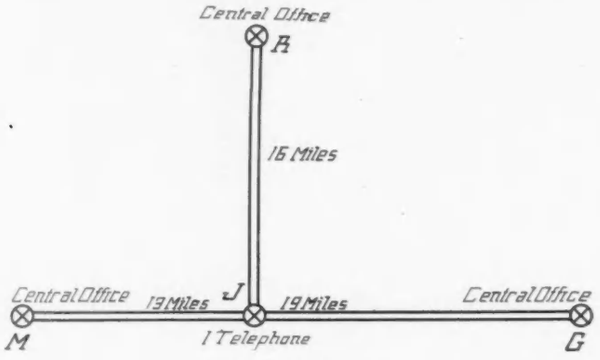
* * *

Replying to inquiry from C. C. B. regarding the proper location and kind of a coil to use to produce a phantom circuit, we do not reproduce the sketch sent in as it represents the exchange or office arrangement and switches, which are immaterial except in that some of the connections should be changed to handle properly the new combination if made.

As we understand your letter, you have two grounded or single lines that are some fifteen miles

long, that they leave your office or station No. 1, and run parallel on the same pole line for three miles, then separate and run in opposite directions.

If we understand your letter correctly we are afraid that you have a condition that will not permit of phantom connections. In the first place it is necessary to have two wires paralleling one another the entire length and of nearly the same resistance in order to produce a balanced circuit. The separation



W. E. G., Fig. 1.

of the lines, bringing the separated ends under entirely different conditions, would preclude the possibility of phantom work. You could not connect and operate two grounded lines, one over the physical and the other over the derived circuit.

If you had a full metallic circuit between stations 1 and 2 you could then produce a phantom and connect any or all of your other lines to either the physical or derived circuit, providing your line conditions were right.

Fig. 1 shows the proper style of phantom coil to be used when each end of the line terminates in a switching station. With this style of coil it would be practically impossible to unbalance the physical circuit even when connecting with grounded lines through the exchange.

Fig. 2 shows the coil of the repeater type, and one of the balanced resistance type. These coils may be used where one end of the line is a switching station and the other end a terminal beyond which point there will be no switching. This circuit has two advantages over the regular repeating coil type of phantom coils. It is much easier to ring over the resistance type of coil than it is on the repeating type, therefore even with one of the resistance coil type we would get the benefit in the better ringing.

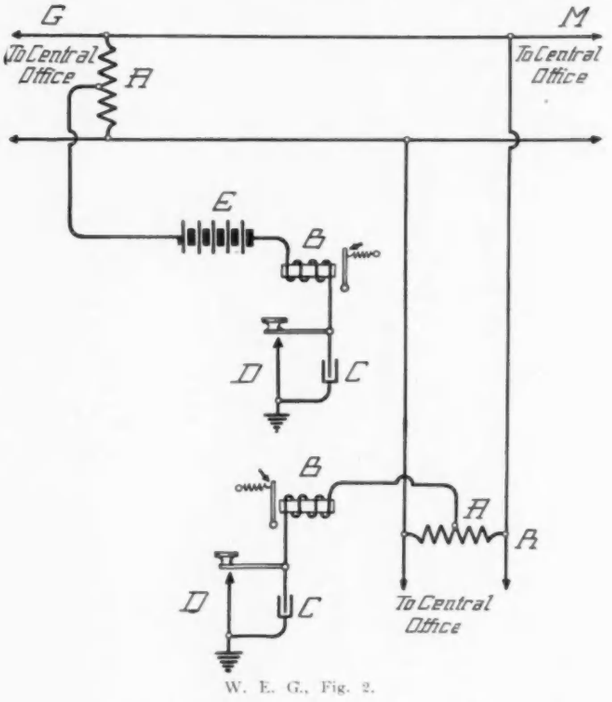
Another material advantage lies in the cost, the resistance coil type being much cheaper.

Fig. 3 shows both coils of the resistance type. These coils will work very nicely on lines which are not intended to be connected to at either end. As mentioned above, they are easier to ring over, which on long lines of high resistance is quite important, as well as considerably less expensive. (It is perhaps needless to say that these coils should be well protected by good lightning arresters and fuses.) In making phantom circuits it should be remembered that the wires composing the physical circuit should be of the same size and conductivity to get good results; in other words, the two lines should have the same ohmic resistance.

What is the cause of a section of a switchboard "going dead," to use the operator's expression, for a few minutes at a time, then "coming back" again, not affecting the other section of a two-section board? For a short time the operator can not hear or be heard and in a few minutes it will be all right again. We are having trouble with one of our ring-off drops. At times it will operate without any apparent cause whatever, actuating strong enough sometimes to pull down the armature and make it chatter just like a regular ring. We are using a pole changer and I don't think it works right anyway, for the company has always had more or less trouble with it.—F. M. R.

There are a number of things that would cause the trouble with your switchboard and make it "go dead." A loose connection at any point in the operator's secondary circuit from the induction coil to the receiver might cause such trouble. There may be a loose connection on or in the coil itself, or in the wires connecting the coil to the listening keys. The receiver cord may be bad or the receiver cord plug may not connect properly with the jack under certain conditions. A few careful tests should show you the exact location of the trouble. If necessary change the induction coil; if this does not relieve it run two temporary wires from the induction coil to the bus bars on the key shelf. If you still have the trouble continue to run it down in this manner until you get it, as it is a difficult matter to tell you just where you can find such a trouble.

The trouble with the ring-off drop is probably caused by a cross with your pole changer circuit, which under certain conditions or connections causes



W. E. G., Fig. 2.

the drop to fall and chatter or stick. You can follow the wiring from this drop carefully and you will probably find the fault. If you cannot locate it, when it comes in again make a test with a receiver and if the trouble will remain a few minutes you can find it by grounding one side of your receiver and testing back from the drop, opening the wire if necessary. Also test the drop coil; it may be grounded on the core.

I would suggest that you write to the company

from whom the pole changer was purchased, telling the trouble you are having, and it will probably be fixed up without delay.

* * *

Can a person manufacture an article or instrument that is patented and use the same in his regular work and for his personal use, where it is also a benefit to the company he works for as well as himself?—H. R. K.

The filing of a patent application and the taking out of a patent is for the sole purpose of protection against infringment or duplication. The original inventor is certainly entitled to the full benefits to be derived from his invention or discovery, and it is the purpose of the government to give such protection by the issue of a patent.

An individual has no more right to infringe or duplicate a patented article for his personal use than has a company. The infringment is the same in either case, and the individual is as liable to prosecution as is a company. An employee using an instrument that is an infringment of a patented article to the benefit of a company or corporation places the latter in the same class with himself and subjects it as well as himself to a suit for damages and confiscation.

* * *

We have a metallic telephone line something like the enclosed sketch; sixteen miles to *J*, where a bridging telephone is on the line, thirteen miles to *M* central office, and nineteen miles to *G* office. What I want to know is if I can operate telegraph instruments at *R* and *G*, using one side of my line for these instruments, without disturbing conversation on the line. When talking and telegraphing at the same time will one disturb the other? Does it require special instruments to operate these two together? If so, where can these be bought?—W. E. G.

You cannot use one side of a metallic telephone circuit for a telephone line; you can, however, duplex or phantom your metallic by the use of coils and have a telegraph line operate successfully between the two staitons *G* and *R*, without interfering with the talking or telephone service on the line providing the line is in good condition and free from bad joints and tree or other grounds.

By reference to our answer to another query regarding phantom circuits you will see that there are two kinds of coils used for this purpose. We would suggest that you use the resistance type and connect the two stations up as per the sketch herewith. Care must be used and the connections properly and carefully made in order to get proper results.

It will probably be necessary to have your line looked over and transposed if it is not already properly transposed. Providing you have no trouble in ringing between the stations *G*, *M* and *R*, that is, if the bells ring good and strong, you might get somewhat better success by the use of the repeating type of coil rather than the resistance type. In Fig. 2, *A* represents the coil bridged to the line with the center point connected to the relay *B* and key *D*. *C* represents a one-half or one microfarad condenser connected so that it is bridged across the make and break of the telegraph key. *E*, the battery, should be of the gravity bluestone type.

The Panama Railway Company will use two-inch galvanized-iron pipe for poles in the construction of its telephone system. Each pole will be 15 feet high and will be equipped with a six-pin, six-foot cross arm, two extra pins being provided for future extensions.

Clark Talks About Poles

At a recent meeting of the Chicago Electric Club a very interesting address was given by Ernest L. Clark on the cedar pole industry, in which he discussed the past history, present condition and future outlook of that industry and its importance to the systems engaged in the transmission of electrical current.

Michigan, Wisconsin and Minnesota have been the greatest producers of poles for the Chicago market, but so great has been the demand for poles from this section, especially Michigan, and so exacting have been the customers as to size and quality, thus making it necessary to cover a vast extent of territory when filling orders, that the supply is becoming rapidly depleted and it is only a question of time when the local supply will be completely exhausted. Mr. Clark stated that in filling an order for 4,000 or 5,000 poles an area of perhaps 100 square miles has to be covered.

But while this is true in the section of country mentioned, there is still a plentiful supply in Idaho and the Pacific coast states. The industry is being developed in these states, which Mr. Clark believes will eventually have to supply this product.

The speaker expressed the belief that while in some respects the western poles were inferior to those of the east, yet in other respects—as for example in size—they more nearly meet the requirements of the present time, and that although the rate of transportation is much higher in the west, they could be supplied at practically the same cost and with a proper treatment would last just as long. Mr. Clark expressed himself as in favor of the open-tank treatment for preservation, citing an instance where poles so treated are still in excellent condition after having been installed seven years.

Telephone Taxes in Ohio.

The Ohio state tax commission has announced that valuations upon telephone companies will be practically double those of last year.

The valuation of the Columbus Citizens Company will be increased from $424,927 to $1,000,000; Toledo Home Company from $420,435 to $1,000,000; Dayton Home Company from $199,355 to $500,000; Cincinnati & Suburban Bell Company nearly $2,000,000 above the 1909 valuation; Central District Company of Pittsburg to be increased from $368,608 to $700,000; Cuyahoga Telephone Company from $972,121 to $2,000,000; Central Union Company, increased to $5,000,000; Cleveland Telephone Company, increased to $3,000,000; United States Long Distance Company to $1,300,000.

The telephone companies are not preparing to submit to these large increases, however, without a fight. H. P. Folsom, representing the Citizens Telephone Company of Circleville; George H. Scott, representing the Citizens Telephone Company of Delaware; William Geyer, representing the Norwich Mutual of Muskingum county; ex-Senator J. D. Johnson of Celina, representing the Celina and Mercer County Telephone Company, and Charles Heck, representing the Champaign County Telephone Company, recently presented arguments to the state tax commission in support of their claims that the new valuations of their property are too high.

Observations on American Systems

By Major W. A. J. O'Meara*

IT seems hardly necessary to say much on the technical side of the telephone engineering. We know how thorough our American cousins are in all they put their hands to. Their success is entirely due, in my opinion, to the scientific spirit in which they approach a subject. No changes are introduced until a complete investigation into each aspect of the situation has first been made. A novelty has to be "tested out" and "proved in" before it has any chance of acceptance. So far as service by means of the multiple switchboard is concerned, not much room for improvement has been left for some years past. However, American telephone engineers have not been content to rest on their oars, and many improved features of a minor character have been introduced into the service; for example, the study of traffic conditions has resulted in the introduction of the ancillary jack, which provides for calls appearing at two or more positions, and thus facilitates team working.

The question of the location of the trunk exchanges has not been, I fear, as deeply studied by us as the importance of the subject demands. In the case of the multi-office urban areas it is as necessary to study the economics of the location of the trunk exchange as it is to determine the theoretical center for a local exchange. The problem is certainly a somewhat complex one to deal with, since it is difficult to assess the relative values of the variable factors which are introduced by the necessity of providing trunk circuits which must serve as sections of channels of communication between several widely separated areas as well as serving as direct channels between closely associated areas. In the case of many cities where the arbitrary attitude of the local authorities has caused us to contemplate the substitution of underground cables for aerial conductors, a study of the transmission efficiencies of those circuits which are built up of many component parts in order to provide a means of communication between the more widely separated centers has certainly indicated the desirability of erecting such conductors on pole lines constructed on routes outside the jurisdiction of disobliging corporations. The American telephone engineers have had seriously to face this problem, since not only do the cities in the United States cover immense areas, but at times the city authorities impose serious restrictions in the construction of open lines. In those cases in which a large number of trunks has to be provided for use, partly for local purposes and partly for extension or through traffic, the location of the exchange is determined by the section of copper required within the city limits to provide for transmission efficiency of the standards adopted for the circuits which have to be installed—that is to say, the question of cost in relation to the transmission efficiency required to meet the various traffic conditions is the ruling factor in deciding whether the trunk exchange shall be located within the city limits or outside the same. At three of the centers visited by me, Buffalo, Chicago and Philadelphia, the "long-distance" exchanges were situated at some distance outside the boundaries of these cities.

As was to be expected, a very complete study has been made of "loading" problems, and practical trials are being made over "loaded" aerial circuits. Many difficulties have been successfully overcome, and during my stay in New York an opportunity was afforded me of talking with Chicago on a "loaded" aerial circuit. The distance is about 1,000 miles, and the conductors are 420 pounds copper to the mile. Even under the adverse atmospheric conditions which prevailed it was quite possible to understand my correspondent in Chicago.

Some very useful information was given me concerning the interferences caused to long-distance telephone circuits by the electrification of railways, and ingenious methods have been devised for partly eliminating the disturbing currents, but the additional apparatus which has to be introduced into loops for this purpose seriously reduces the efficiency of the circuits for telephone purposes. The invention of telephone repeaters has received considerable attention, and they have been installed in quite a number of circuits, but unfortunately I had no opportunity of making observations on any circuits so equipped.

Perhaps of all the interesting questions which were discussed, the most important is that relating to the development of the automatic and semi-automatic equipments. It was my good fortune to see no less than five different types of switch equipment, designed to provide automatic and semi-automatic telephone service, and I also had the advantage of discussing the question of providing service by means of these new types of equipment, not only with those who advocate these systems, but also with those who are opponents of the automatic systems. A matter which has been much debated is that relating to the probable attitude of the public towards a service provided by means of full automatic systems. The question naturally arises whether the public will take kindly to the task of calling their correspondents when once the novelty of the apparatus has worn off. I think the non-committal answer of "wait and see" is the safest at the present moment. True, at the present time, some 200,000 full automatic stations are in operation in North America, and the advocates of the system point to this fact in support of their contention that the public prefer this system. On the other hand, the opponents of the system claim that it is the novelty of the thing which appeals to the public. The whole question certainly requires the serious consideration of telephone engineers in England. We have yet to learn from actual experience whether the automatic and the semi-automatic equipments provide sufficient flexibility to cover the wide range of requirements of the British public, how far the mechanism is reliable in the care of such men as we can train to maintain it, and how the cost of first installation and the annual charges in respect of depreciation, maintenance and traffic operation compare as a whole with similar costs in respect of existing types of installation.

*Abstract of an article in the *Post Office Electrical Engineers' Journal*, London. Concluded from September.

Who's Who in the Telephone Game

Facts and Fancies About a Man You Know or Ought to Know

PERHAPS you know a man who is ever effervescently enthusiastic over his work; who has no time for anything else unless it be his family; who cultivates the inspiriting smile by backing it up with delightful service painstakingly performed. Perhaps you do, but it is usually the rare exception.

There is at least one character of this kind who graces the telephone engineering profession by his dignified knowledge of mysterious and magical small currents. He has found a way to specialize within the sphere of telephone engineering, which is all the more remarkable when you recall the apparently narrow confines of the profession.

Cultivates the Inspiriting Smile.

You are acquainted with family—John and Estelle — pleasing young buds; and you know the Fuller girls — Louise and Elizabeth—and the Fowle boys, James and Alexander; but are you acquainted with Frank Fuller Fowle? Behold him!

If Bert Taylor had this name he would whittle a hee-haw out of it. Frank Fuller Fowle — think it over—it is a terrible strain on cap F's! Well, anyhow, this is the effervescing enthusiast who loves his work. Here, too, is the man who specializes within the limited range of telephone engineering, and in passing, here is the rare case of a practical theorist, if you can get that! Fowle has written only one book — his "Transmission Line Crossings," but he has contributed great gobs of technical stuff that has been grabbed up and spread through electrical magazines, later to find their place in booklets and pamphlets that were used to get the idea up to the right man. His "practical theories" have commerce stamped all over them—water-marked in the sheets—blown into the glassware. He knew it all the time, but you didn't see it there until quite some time afterwards. Nowadays you are beating a path across his premises to meet that inspiriting smile, and you are glad.

Frank Fuller Fowle was born in San Francisco thirty-three years ago. Right after his christening he was hurried across the continent—all the way across, to Boston. When he had finished with Boston's public schools he entered the Massachusetts Institute of Technology, graduating from its course of electrical engineering in 1899. During his institute work he had four months' practical experience in isolated electric plant operation. It was his full extent of "practice" before he entered the engineering department of the American Telephone & Telegraph Company at New York. He was assigned to the experimental department. His studies included transposition to eliminate cross-talks and induction from power lines; transmission and tests, including loaded lines; switch-board and power plant design; testing of motors, generators, dynamotors and engines; special investigations. His duties also required extensive traveling. He was all over the country, examining, directing, testing long-distance lines. Doubtless some of his height is due to this work. He can't stand on the ground and inspect all of the cross arms on a seven thirty, but he can come nearer doing it than you can, for he is safely over six feet. His company retained him in this work until 1903.

Then he was made special agent in the railway department, and for three years he investigated railroad telephone and telegraph conditions. Naturally this required more traveling, and a lot of it. He hobnobbed with railroad officials, advising them on telephone matters particularly. He planned special forms of service for railways; designs for various railway telephone systems, with estimates; rate and cost studies.

In 1906 and for two years thereafter, Mr. Fowle was manager of the Chicago territory of the A. T. & T. long-distance system, in charge of operation and maintenance. His headquarters were in [illegible]. He reorganized the office and introduced many changes to improve service—his wide experience in the work serving him admirably.

But then he quit—a remarkable achievement for a Bell man who had been getting along so famously.

Frank Fuller Fowle is for himself. His card reads: Consulting Engineer. His activities are largely within the electrical field, including telephone, electric light and power. He makes appraisals; electrolysis investigations; reports upon operating conditions, and so forth.

Mr. Fowle is an associate member of the American Institute of Electrical Engineers; a member of the Railway Signal Association; and Association of Railway Telegraph Superintendents. He lives in Chicago, is married; has two sons, and further, deponent sayeth not.

Fowle on Depreciation

At the meeting of the Chicago Electric Club, September 21, Frank F. Fowle delivered an interesting and instructive address on the subject of "Depreciation and Its Relation to Appraisals." He pointed out the essential conditions that have to be met and outlined the most approved practice in use by electrical and telephone companies at the present time.

All properties that are built of material and contain machinery and apparatus depreciate. The factors that constitute depreciation consist of first, wear of machinery and apparatus; second, corrosion and decay, as in poles, lines and apparatus exposed to weather; third, obsolescence; fourth, inadequacy.

Depreciation must be taken care of for the protection of investors, and to provide funds for reconstruction. The problem of method in financing depreciation is an important one and the financial, the economic and the physical aspects of the problem must be considered.

Two commonly employed methods of preparing for a depreciation fund were outlined by the speaker, and his description of them was illustrated by a chart showing both methods.

The method preferred by Mr. Fowle is known as the straight-line method. In this method it is assumed that a property depreciates uniformly each year during the scheduled life of its equipment, and a certain fund is set aside each year until the entire investment is written off.

The other method, known as the sinking-fund method, is carried out by setting aside each year a certain predetermined percentage of the investment, until the fund, plus the accrued interest, amounts to the investment in the property.

William B. Jackson discussed the two methods, expressing a preference for the second, or sinking-fund method.

Telephones at an Aviation Contest

Owing to the fact that almost at the last moment the location for holding the Harvard-Boston aviation meet, September 3 to 15, was changed by those having it in charge, thus making it impossible to install telegraph service, the telephone was utilized, it doubtless being the first time that an event of such international importance in the sporting world has been reported entirely by telephone. The service was supplied by the New England Telephone and Telegraph Company. Temporary connection was established between the Dorchester exchange of the Boston district and the field at a central point in the rear of the grandstand by means of a 30-pair lead-covered cable, and from this point connection was made with various points in the field. In all about 2,400 feet of cable was used.

The representatives of the press were connected with the Boston daily papers by direct line, and as the events transpired the news was immediately transmitted to the various offices. Telephone service was also provided for the various officials, at the main office of the administration building, and pay stations were installed throughout the field for the use of the public. Connection was also made with the Blue Hill Observatory of Milton, for the purpose of receiving immediate notice of changes in wind velocity or other atmospheric conditions, before and during the contests.

At the suggestion of Chairman Glidden, of the contest committee, special connection was made with the Hull life-saving station, so that when the aviators passed in and out in the circle around the lighthouse instantaneous reports might be received from Boston Light. Following a wig-wag signal given by the lighthouse-keeper to the life-saving station, the reports were given and the time taken by chronometer.

Telephones and Forest Fires

In protecting forest reserves of the United States from fires the telephone has become an instrument of salvation, and there are many cases on record in the forestry bureau where this modern appliance has saved innumerable lives and many hundred thousand dollars' worth of timber.

The installation of the telephone service in the national forests, where there is naturally much isolation, is counted on, not only to prove of great convenience to the men engaged in the administration of those vast tracts, but also to save property and lives. Former Chief Forester Pinchot introduced telephones and the patrol system of the forests and during the four or five years they have been in use, the system has been extended until today there are more than 600 miles of telephone wires strung through the various reserves.

The only possible way to control these fires is to prevent them—that is, attack the fire at its inception. It is at this point where the telephone gets in its work and has demonstrated itself as an important factor as a machine of salvation. As a means of preventing fires and to discover those which have not gained any amount of headway, thousands of men have been employed annually, by the government, as rangers and patrolmen. They are assigned to districts which they are called upon to patrol, but the work of this patrol system did not really become effective until the telephone was introduced.

Before the days of the telephone the ranger, after discovering a blaze, was compelled to ride to the nearest settlement, which might have been one or two days' ride, to obtain assistance. During his absence the fire would get beyond human control and he and the men at his command were practically helpless.

The use of the telephone on the forest reserves is not a suppositional nor merely contingent matter. The officials of the forestry bureau contend that its trial has been practical and it has been proven by time to be invaluable.

Meteor Visits Telephone System

Darting and whirling through the air with the speed of a falling star, a great ball of fire like a meteor descended on Kenosha, Wis., and striking a wire of the Kenosha Home Telephone Company, burned it apart and put three hundred telephones out of commission. Hundreds of people saw the strange ball of fire and many declare it was about ten inches in circumference. It is supposed it was a meteor, but nothing could be found to show where it had buried itself in the ground.

Telephone Exchange Directories

By Will M. Traer and J. E. Magly

WE are in receipt of a copy of the exchange directory of the Knoxville Electric Company, Knoxville, Iowa. It is made up in neat form, very complete and well printed, showing a very substantial list of city and rural subscribers. One item under the head of "What Telephone Users Can Do to Help the Service," is particularly pertinent and is as follows:

"There are three parties to a telephone call: the person making the call, the telephone company and the person called. It is not sufficient that one or two of the above parties do their work properly, the co-operation of all three is necessary."

Complete information regarding the toll service of the company is printed apart from the general information under a separate head, "Toll Service."

* * *

Under the direction of A. T. Nelson, secretary and manager, a new exchange directory has recently been issued for the Laclede County Telephone Company of Lebanon, Mo. It is made up of good white book paper with a heavy document manila cover, size 5¾ by 8¾, and contains 68 pages.

Following each alphabetical classification of the city list, there appears a rural list belonging to the same classification with the word "Rural" as a sub-head. The subscribers' names are set in eight point capitals with the numbers in bold face, giving the pages a very pleasing appearance. The book is round cornered, punched and strung with a patented wire loop.

Quite a lot of well displayed local advertising appears on the left hand pages of this directory. In fact, there is enough to defray a considerable portion of the expense of the issue.

* * *

A very neat little exchange directory was recently issued by the Deer River Telephone Exchange of Deer River, Minn. It is 5 by 8 in size, and it is made up of a heavy machine finished book paper and a document manila cover. The cover is printed in two colors, the book is punched and strung with a wire loop and altogether it is very attractive and serviceable.

This size, 5 by 8 inches, is very well adapted to the small directories, from sixteen to twenty-four pages, and will take care of a substantial subscription list as well as a good deal of advertising.

* * *

We have at hand the exchange directory of the La Porte City Farmers' Mutual Telephone Company, La Porte City, Iowa. It is printed on a medium weight of document manila and made up in a very novel form with a side index, each page being a trifle wider than the preceeding one. This style of indexing is not bad—in fact, it is very convenient; but it surely does interfere with the good appearance of the book. It makes a very narrow cover page necessary and because of the width of the last pages would not be a very satisfactory method to apply in the case of an exchange of more than four or five hundred subscribers.

The printing in this particular directory is just fair. The marginal indexes are too small and light faced.

We have just received a copy of the August exchange directory of the Maxwell-Brady Telephone Company and from some of the advertising we note that it was issued from Brady, Neb. It seems to be common in the case of a good many exchange directories to forget the name of the headquarters town entirely. This would indicate that the telephone company totally loses sight of the fact that its exchange directory is a piece of advertising.

The Maxwell-Brady book is fairly well printed with the exception of the half-tones of the "Right and Wrong Way to Talk," without which the book would be better off. It is also improperly stitched, being side-stitched instead of saddle.

Local advertising appears in the booklet with utter disregard of uniformity as to its location. In some cases it is at the bottom of the page, in others it occupies a full page and on some facing pages there appears none at all. If a certain space were set aside and this plan adhered to, the general effect would be more pleasing. In this case there is hardly room enough on the outside front cover for the name of the telephone company, two local advertisements occupying two-thirds of the page. We believe in carrying advertising in telephone exchange directories, but we also believe that the outside front cover should be reserved for the telephone company exclusively.

DIRECTORY EFFICIENCY.

Once more we wish to remind our readers of the possibility of making the exchange directory almost, if not quite, pay for itself, and at the same time make it a valuable reference book for both the householder and business man.

A model directory embracing the latter feature might contain the local railway time tables; the names and addresses of the local mayor, marshal, chief of police, street commissioner, boards of health and review, board of aldermen, city clerk and other city officials; the hours of closing the mails at the local postoffice; the names and addresses of all county officials, including the board of supervisors or county commissioners with dates of their regular meeting; also names and addresses of court officials with dates of court sessions. The more important city ordinances might be included and even such information as "first aid to the injured," and tables of weights and measures would add to the usefulness of the directory. All this information could be condensed on two or three pages at a very small increased cost to the telephone company.

As to the first mentioned feature, the principal source of revenue which can be derived from the issue of an exchange directory is, of course, through the local advertising that it may carry. The only proper way to solicit advertising for a medium of this kind is to have the printer make up a dummy, or, to be explicit, a book of the same size and style as it is intended to make the directory with the same number of pages and set aside certain space for advertising. We prefer the use of the left hand page all the way through if it is possible to get enough advertising to fill; if not, let it run as far as

it will. This space may be divided into eighths, quarters, halves and full pages.

Adopt a rate for the full pages and make a slightly increased rate for the fractional pages. Have the dummy gotten up in a neat form and if possible have your cover printed and used upon the same. Don't make your rate too high, but consult with your printer and have it high enough to pay the cost of inserting the advertising and the cost of solociting with a profit to you of 25 per cent or more. In the case of an ordinary 6 by 9 booklet with an edition of 1,000, $5 per full page is a very fair rate for the advertiser and a profitable one for the telephone company.

Before you begin soliciting, sum up the best talking points in favor of your directory as a local advertiser. You may elaborate on the fact that the exchange directory is consulted more often than any other reference book, magazine or periodical. If you take hold of it like you mean business you should not have a great deal of difficulty in convincing a good many advertisers that it is a more valuable publicity medium for them than the local newspaper and that it is not to be compared with hand bills, circulars, etc. Compare its cost with other methods of advertising, calling attention to the fact that it is alive and in constant use for from six months to a year or more and you bring out one of the best points in its favor. You must believe in it yourself and be active. Don't overlook any possible advertiser. If you do this, you will be able to realize a substantial profit on your advertising that will go a good ways toward defraying the expense of the directory.

Another source of revenue is through the listing in bold faced type of your local business concerns. This costs you practically nothing extra and in most cases you can get from fifty cents to one dollar for each listing. Generally it is not difficult to secure a good many listings of this kind and, as every dollar helps, it is surely worth while.

We would be glad to hear from telephone companies who will put either of these plans into effect with success. We have personally known of a number of instances of the kind and no failure.

Difficulties of Commission Supervision

The fact that the telephone and the telegraph companies have passed under the jurisdiction of the interstate commerce commission and became classed as common carriers, apparently means nothing to the corporations engaged in that kind of commerce between the states, says a Washington, D. C., dispatch.

The law requires interstate commerce carriers to file and publish schedules of just and reasonable rates. As yet not one of the companies has done a thing to indicate acceptance of the new order of things other than to notify holders of franks that they would not be honored from this day forward.

The companies have not even taken notice of the law to the extent of blotting out the announcement carried in nearly every telephone directory that the rates carried therein are subject to change without notice. That announcement is no longer true.

The first question likely to come before the commission is one of jurisdiction. Practically all the telephones in the country are part of an interstate system of lines. Nearly every telephone company advertises its service as local and long distance. If every one is a long distance line, then, except in a few cases, it comes under the control of the interstate commerce commission.

Next will come the question of competitive rates, or rates to competitive points. It will be incumbent upon the commission to say, when complaints are made, which rate is the proper one.

One of the questions that will be fought out is as to the right of the local company to withdraw its service because a subscriber refuses to pay a charge assessed against him for a long distance call. In Washington the local company refuses to recognize an order given by a subscriber that his telephone is not to be used for outgoing long distance messages. The subscriber might put his telephone in his safe, the answer was, or lock it up in some other way, but calls for the long distance would be recognized without regard to the notice and the charges would be paid, too, or there would be no local service.

The local and long distance systems are so closely knit that the commission, it is believed, will have to assume a very large measure of control over local exchanges, as to rates and practices, as to amount, almost, to a control of all urban business by the federal government.

As to Telephoning Prescriptions.

New appliances of various sorts, labor-saving devices, sciences and inventions are continually springing into existence and use. The latest wrinkle in this line is at the present time interesting physicians and bids fair to become a subject of controversy, the decision of which will vitally affect the public.

"To prescribe for patients by telephone, or not to prescribe," that is the much-mooted question, and on it the medical sages are evenly divided. Whether it is better to let a patient suffer until the arrival of a physician, or in case such as these where serious consequences may result from delay, to telephone the ingredients of the remedy to the druggist, and thus possibly afford an additional opportunity for a mistake of a serious character, is the dilemma which is confronting the profession.

A writer in a German journal questions if more accidents do not result from the illegibility in writing which is almost proverbial in prescriptions, than misunderstandings in telephonic communications, and endeavors thus to justify the utilization of this method. The dangers, however, whether they are real or assumed, have led to official and semi-official action in Germany, and several precautionary measures have been suggested. One of these is that the prescription has to be written out and read over the telephone, repeated by the pharmacist and sent to him in written form as soon as possible.

Texas Convention This Month.

The sixth annual convention of the Texas Independent Telephone Association will be held in Dallas, Texas, October 26 and 27.

Through the courtesy of J. C. Casler, promoter of the Dallas Telephone Company, the meeting will be held in building just being completed by that company. The spacious and well lighted basement of the building will be used by the manufacturers in which to display their exhibits.

Glasgow's New Exchange

By Alfred H. Rice

THE new telephone exchange in Glasgow, Scotland, presents a number of distinctive features. The first of these is the installation of the entire equipment upon a single floor, including the power plant, test room, switchboard and offices. This convenient arrangement is made possible by the ample dimensions of the new Postoffice building, and is shown by Fig. 1. The tele-

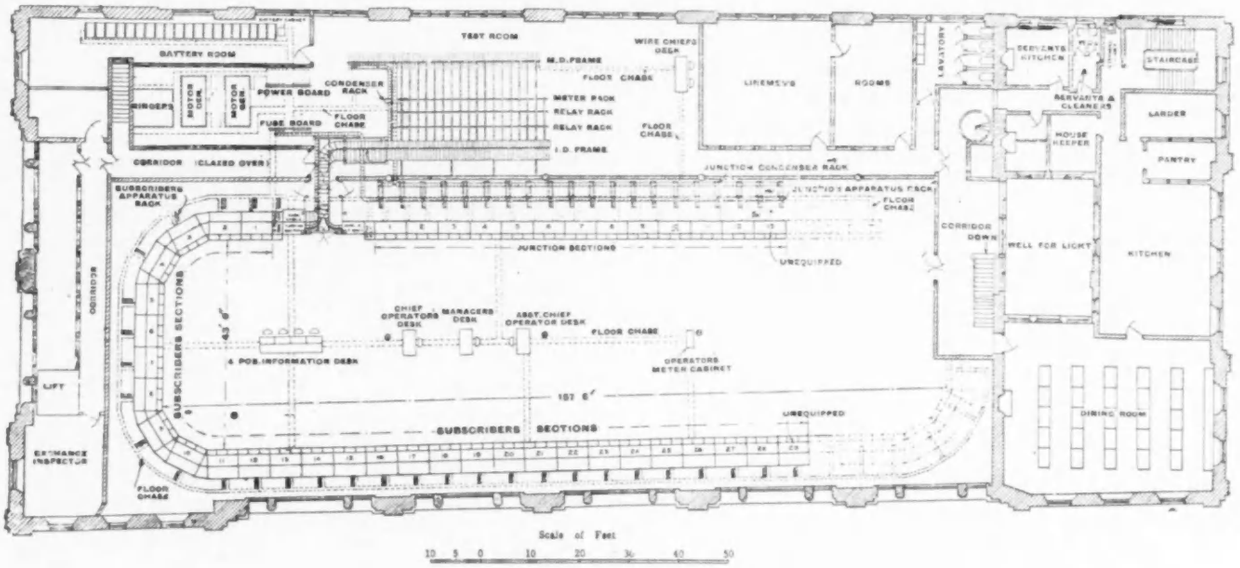


Fig. 1. Floor Plan of the Glasgow Exchange.

phone exchange occupies the entire second floor, and there is ample lighting provision made. The position of the pillars supporting the roof allows ample space for the switchboard.

The call-wire system was adopted some years ago in Glasgow; but progress in the design of telephone exchange equipment has proved that the method is complicated. When the postoffice acquired the telephone plant of the Glasgow Corporation, the call-wire system was abandoned. The new exchange is the first to supersede a portion of the existing call-wire equipment of some 5,000 subscribers' circuits which have been gradually transferred. At the same time the new plant makes provision for an additional 5,000 lines, a total of 10,000 for the exchange.

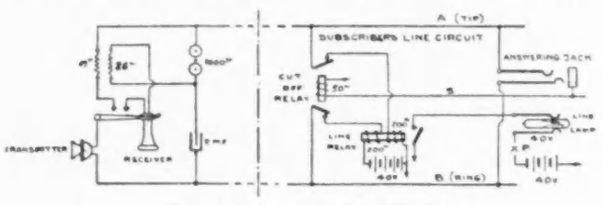


Fig. 2. Subscribers' Line Circuit.

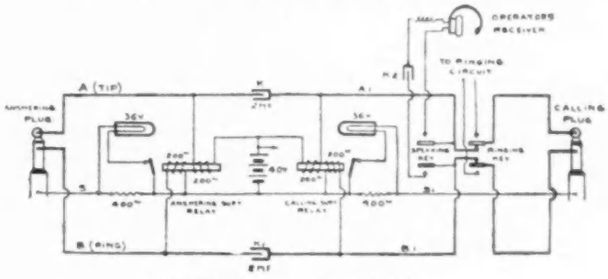


Fig. 3. Subscribers' Cord Circuit.

Two direct current three-wire services have been laid in to the exchange from the mains of the Glasgow Corporation light and power department. From these a supply of 500 volts is given to the motor generators. A nected to the 250-volt service line, the other is operated at 40 volts from the 60-volt generator bus bars, a choke coil being used to reduce the pressure. The battery comprises twenty Chloride cells having an ultimate capacity of 3,230 ampere-hours. A 1,000-ampere two-pole double-throw switch connects either generator to the battery. The latter is protected by a 500-ampere fuse enclosed in an air-tight cabinet erected near the end cell on the negative pole. The negative battery lead can be disconnected by means of a 1,000 ampere switch, which can be used only when the battery is disconnected from service, one of the generators having been switched in for supplying current direct to the exchange.

The transmission system is a modification of that devised by J. S. Stone in 1892. The 40-volt common battery is connected to the tip and sleeve conductors of both

sides of the cord circuits through 200-ohm supervisory relay coils. For transmission purposes the two tips and the two ring conductors of the plugs are connected together by two micro-farad condensers. High impedance between the battery and the conductors of the cord circuits ensures freedom from cross talk.

Figs 2 and 3 are diagrams of the subscribers' line and cord circuits. The connections for the subscriber's station are those of the department's standard common-battery instrument. The small private branch exchange is not catered to in Glasgow; hence there is no objection to the presence of a 200-ohm line relay coil between the negative pole of the common battery and the sleeve wire of the circuit. The same argument holds good for the cord circuit, where a 200-ohm supervisory relay coil connects the common battery to each sleeve conductor.

The entire telephone equipment was manufactured and installed by the Peel-Conner Telephone Works, Salford, England.

More About Frisco's Chinese Exchange

One can scarcely imagine anything quite so incongruous as a group of Chinese girls, as truly Oriental in every feature as the picture on this page seems to indicate, seated before a telephone switchboard of an ultra-modern American type, plugging in and answering calls in the most approved "hello girl" style. But one need not go further than San Francisco to find this.

The population of Chinatown is business-like enough to need telephone service, so it has been provided with its own exchange, which fits into the telephone equipment of the surrounding city in a manner altogether peculiar. Something of the reasons for and arrangement of this exchange was told in Telephone Engineer for January, 1910.

This exchange is one of nine of the Pacific Company and is located on Washington street in the heart of Chinatown, a few blocks from the Bush street central office. With the exception of the sign outside the front door and the fine new multiple switchboard within, everything about the building is truly Chinese. The manager of the exchange is a Chinaman, so is the chief operator, and the switchboard operators are Chinese boys and girls.

The manager, Loo Kum Shu, an American-born Chinaman, has been associated with the branch of the Bell company in San Francisco for about ten years. Mr. Loo has complete charge over the 3500-line board and his little operating staff. The chief operator's name is Ah Sing. Like the manager, Ah Sing speaks good English, and so do the three little girl operators, whose names are Ah Mee, Ah Bow and Ah Soo. The other three operators are Chinese boys. These young people have been recruited from the mission school in Chinatown, and they are said to make excellent operators.

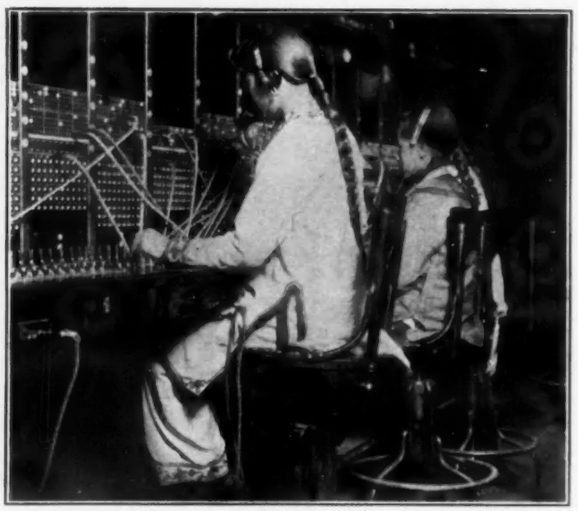
Some little time ago, when Chineses telephone commissioners were in this country investigating telephone plants for their home government, they were shown this Chinatown exchange and were much impressed by the work of the Chinese operators. It was demonstrated to them that an American switchboard can very conveniently be adapted to the uses of the Chinese, and this is believed to have been one of the reasons why they selected for the first exchange of the new Peking system an equipment from the same shops at Hawthorne, Ill.

The switchboard at present in the Chinatown exchange is a comparatively new one, having been installed since the big fire in 1906 in San Francisco, which completely destroyed the telephone building and equipment then in use. It is now taking care of 800 subscribers' lines. The board is a Western Electric No. 1, a central battery equipment of the most up-to-date type.

This exchange handles only calls for stations in Chinatown. Whenever a call from an outside station destined for other points comes in the operator switches it over to the Bush street exchange.

The quaint costuming of the Chinese operators is one of the sights of this exchange. A photographer for the San Francisco *Call* was able with difficulty to obtain the accompanying view of one of these girl operators seated before the board in her loose pajama-like garments, with her long pig-tail of black hair down her back.

These girls know the names of nearly all the Chinatown subscribers and are able to switch the calls about without resorting to the directory. As a matter of fact, the Chinese part of the San Francisco telephone directory



Chinese Operators in San Francisco.

is not arranged by numbers, but by names of streets, and a caller for a station in Chinatown gives the name of the firm or individual he wishes to reach.

The Chinese subscribers invariably demand individual lines and are very heavy patrons of toll lines; in fact, they prefer long distance telephony to all other forms of correspondence. Furthermore, the Chinese merchant is unusually prompt in the settlement of all accounts and very reasonable in all of his dealings with the company.

This exchange is probably the only one of its kind in the United States, and without doubt the view of the interior cannot be duplicated any place outside of China.

In the basement of the building containing the cable rack and all other apparatus other than the switchboard, the usual standard construction of the Pacific Telephone and Telegraph Company is carried out.

The energy for this exchange is obtained from 11 cells, type E-11 "Chloride" accumulator, manufactured by the Electric Storge Battery Company. The battery is charged by means of a 30 ampere mercury arc rectifier.

The Lehigh Valley Railroad is installing telephone dispatching circuits between Jersey City and Easton, Pa., and between Penn Haven Junction and Wilkes-Barre.

What One Woman Thinks

By Sarah Elizabeth Brown

AND so you've added to our family of readers the former subscribers of the *Western Telephone Journal*, that stalwart, red backed—or was it red-fronted—independent journal made famous by Lichty and Traer? Welcome to our midst, all you horny-handed sons of toil! But don't tell me your troubles, because I have enough of my own. I warn you, because some of you have already written to me. There is nearly always a veiled insinuation, if you can discover what I mean by that, that I'm non-existent. Ha! ha! and Ho! ho! you skeptics. Me, one hundred and eighty on the hay scales, with no shape at all except on Sundays when I fix up for church. No hair to mention, except on the same or exceptional occasions. Oh, you men, I'm very, very real and if I wasn't so old and so homely I'd let the publishers print my picture just because I'm human and have something of the itch for seeing myself as others sometimes see me. I'll do it, too, if I ever get the time to have my picture taken by a professional photographer. I'm willing to confess that my stuff is liberally edited, but that is all. It originates right on my premises and while most of it comes off the dining room table while the dishes are waiting to be washed, that isn't the only place where I jot down my original thoughts.

* * *

We have come to the end of the roasting-ear and the honey-suckle and are at the threshold of the sere and yellow leaf. Out in the country these are signs of fall. My summer kitchen has been turned into a canning plant. The gasoline range is all right for that and the noon meal, but there have been a few mornings when a fire in the cook stove felt pretty good. John and Robert Phelps have gone to Cleveland and to Case College. I told you about John's enthusiasm last May. He has nursed it all summer while looking forward constantly to his leave-taking. His going away records the first to wander from the family hearthstone, but I must get used to that, for there are three more who will doubtless do the same thing.

Obediah had his first lesson in enforcing penalties when John wrote back for $50 as a deposit required of students to insure against their depredations at school. My, what a jar to deportment. John's explanation is that the boys are such a live bunch that when they get started there is no end to what they'll do. If the power plant smokestack doesn't seem to be in the right place, some of the students are apt to take it down on a dark night and hide it in an obscure alley. The management of the school, as a protective measure, requires each student to make a deposit against which such losses are charged. I have heard that something of the kind is practiced by certain manufacturing associations, but it is the first time we have met it face to face. Deposits of this kind might hold competing telephone systems to the straight and narrow path, but it seems like the idle money is always required for other purposes.

* * *

What is all this racket I hear at Macon, Missouri? It has been quiet down there for so long I had come to believe that Theodore Gary had 'em all eating out of his hand. From what I can learn, the Bell company has obtained a twenty-year franchise to operate a competing system in Gary's home town and contemplates an active campaign. The Bell threatens to spend $80,000 in Macon where there doesn't seem to be any immediate need for another system. The trouble is in Gary's refusal to connect his system with the Bell. Let me see. Mr. Gary has the long end of the situation. He has a splendid system rendering satisfactory service. He believes in competition in the telephone business. I've heard him extol its beauties, drawing a picture of how independents waded in and developed business where people cried for service. He has been of that stalwart organization who decry monopoly. I have admired his sterling independent qualifications, his clean life and its purposes. But here is a condition I can't grasp. It would seem that Gary has had the best of the situation in Macon for a long time. He has beaten the Bell in the development of territory. If competition is a good thing, why should he now tear his hair that a competing company sees something that has hitherto been overlooked? I have been a lay member of the telephone business for ten years. I have told you that there are only a few scattering Bell stations in our county and I know Obediah and Ben Phelps would throw fits if the Bell would attempt to knit its tentacles into this little pasture which we proudly claim as our own. But for the life of me I don't know how we could help their coming if they made up their mind to do so. Isn't it that way in Macon? Would the Bell, foolish in many, many ways consistent with corporations, spend $80,000 in Macon if there was no reason for it?

You telephone men, answer me. You know, and I know that the Bell wants a connection with the Gary system. They have run amuck of a hard-headed, square jawed fighting patriot. In the simple judgment of one innocent bystander, here's the place for state commissioners, for an arbitration board under government jurisdiction, for a law compelling interconnection, or for something that will help to adjust a problem where men and money go rampant. There is no need of more service in Macon than Gary can supply. There is no need for Gary to build a toll line from St. Joseph to Hannibal by way of Macon. Competition is a good thing when you enjoy your own little monopoly, but it is awful when it is real!

* * *

Much defaming stuff is being written against the banker, now-a-days. I've been trying to figure out the why of it and there is only one answer. The plain pee-pul have too much money! I look at myself and my people and my neighbors and their people. I rubber back into time two decades and my convictions ring true. I know when we got our first two-seated carriage and how proud we felt that we could have it. It cost $135, plus a lot of self-sacrifices in clothing and house furnishings—things which we seemed to need far more. Then I look out there at that concrete garage in a corner of the barnyard that was never intended for a building of any kind and I see the reflection from the

big lamps on our luxurious touring car. The room at the right houses the "trouble wagon" when it isn't out on the line somewhere, but it, too, pays a small tribute to John D. We are prosperous to a degree that exceeds by far the wildest flight of my earlier recollections. We had some trouble when we tried to sell $50,000 worth of bonds, but we sold them, all right, after a few calls upon "arrogant bankers," who attempted to throw cold water on the project; but we haven't seen a banker since—except when we slide our money through his wicket. In the old days the banker was hard and greedy. His interest rate was extortionate and his greatest pleasure was to squeeze the unfortunate. There may be a few of the old type in remote places, but they are exceptions, rather than the rule. The modern banker is the balance wheel of the local community. He is consulted in every commercial transaction of importance. His advice is sought by members of the entire family and his counsel is relied upon. His sympathies are governed by a cool and level head. He is remarkably human. With the advent of the new banker have come changes in banking methods. The attitude of banks toward the public has changed. I remember that when we first had to deal with banks, Obediah was subjected to a catechism which included me and our parents and their parents. We were required to maintain a certain amount as minimum deposit, or in other words keep a balance satisfactory to the bank. Some of these earlier traditions hold in the minds of some people when they think of banks, but show me a bank that will refuse an account or fail to accord every courtesy to the depositor and I will show you my two-headed billy goat over the hill. I can remember when Old Jim Clayton was a "hard-hearted Shylock" in the eyes of our earlier settlers, but I recall his funeral and the floral emblems and the biggest turnout that ever came to our town. I remember that time mellowed our hearts toward him and that his son, who succeeds his father, is the one man in town we want our boys to emulate. Venerable Old Jim knew how to make better men and women of frontier stock and he lived when we were poor. In the passing of time, it isn't fair to measure the present by what took place twenty-five years ago.

* * *

Which brings me down to watered stock. I believe that the capital stock of any concern should represent approximately par. If a concern starts off with a capital of $10,000 fully paid in, and by shrewd management it can earn six per cent the first year, twenty per cent the next year and fifty per cent the next, it is time for a stock dividend. Call it water, or not, stock earning fifty per cent is a bad commodity to market. Better have the stock dividend at this period and inject some water, but be sure you are able to maintain the earnings. Income is the revenue of your investment. While few of us enjoy fifty per cent dividends on our actual cash outlay, some of us do get that much on our investments, although it is doled out at the rate of ten per cent per annum. The difference is water at 109. Arthur E. Stilwell has written a book which he calls "Confidence or National Suicide." In it he shows how the capital stock of Great Northern might all be water—something like $210,000,000—and that were it true, J. J. Hill should still be considered greater than he is because his railroad has brought to a new country in wages alone more than $1,000,000 a day. Upon Stilwell's estimate, this single item is less than six per cent on five billion dollars. Estimating on enhanced realty values, Hill's railroad has been responsible for $6,400,000,000 of added wealth. Crediting Hill with simple interest at six per cent for ten years, and this would give him a little more than half of that sum. It is evident, then, that some of our financiers have not been as ardently in favor of water as I am. I only wonder that some of them haven't taken the earth.

* * *

The Ohio state tax commission has doubled the tax valuations of telephone companies. Well, that's one way to show appreciation for Morgan! I have heard that an audit of the Morgan properties has been completed and that a great deal of money will be required to bring the plants up to a state of efficiency that will prove acceptable to the present owner. It is also given out that in all likelihood a holding company will be formed to take over all the properties, after which some bonds will be sold to take care of this rehabilitation. Morgan will sell the bonds. I say, Obediah, I'm going to buy Minnie a hat with that $10 you gave me for my own. Let me have another ten. Oh, I tell you, fellows, this game of finance is always easy if you know how.

* * *

I have heard from P. C. Burns. Saw it in a telephone paper where he had sold his common battery interests to the Stromberg-Carlson Company. Well, ours is a magneto system and we are not interested, personally, but here is evidence of some sensible consolidating. I hope there will be no restraining orders. If the manufacturers of apparatus would work to certain standards, it wouldn't be so bad to have so many of them, but when they don't do this the confusion is sometimes most annoying—especially when you are considering the purchase of new stuff. The apparatus itself is good, these days, no matter from whence it comes, and it is remarkably similar. The greatest problem, as I see it, is the tendency to make the selling of it an extravagance. Doubtless reforms will suggest themselves, if the plants begin to get together.

* * *

I suppose I will have to wait till I hear about cutting the automatic into service in Chicago. I'm anxious to know what kind of service that system will provide in the big metropolis.

Railway Telephones in the West.

Telephones have been installed all along the line of the E. P. & S. W. for auxiliary use in case of the telegraph wires going out of commission through accidents, thereby safeguarding the traffic throughout the system. In conjunction with this new improvement and facilitation of the late methods of train dispatching comes the use of the telegraphones which also keep the dispatcher's office in constant touch with the workings of the wire.

The general interest that is being displayed by lines all over the United States in the placing of the telephone method of train dispatching instead of the telegraph is becoming daily greater. West of Bisbee, Ariz., work in this direction was commenced some time ago and wiring has been done practically to Los Angeles. A delay has been experienced, however, and it will probably be some months before the work is finished.

High Resistance Measurements

By Prof. Arthur J. Rowland

THE measurement of electrical resistance is one of the most important in electrical engineering; no matter whether it is done in a research laboratory or in connection with tests to determine the efficiency and safety of a line or piece of apparatus. A number of methods are in use; some better adapted to the measurement of low resistance and some to high resistance determinations. In all of them indirect methods are almost invariably employed and yet the advantage of being able to make a reading by direct observation when measuring resistance, is as great as for any other thing capable of being measured. And while everyone knows this, there are enough different good reasons to make it worth while to remind ourselves of what they are by tabulating some:

a. The satisfaction in taking a direct reading; no waiting for the result.

b. The speed of reading and of checking results.

c. Anyone can make the readings.

d. Errors are much less likely than by other methods.

But the instruments which have been available for directly measuring resistance are ohmmeters, which are either electro-dynamometers, or those which are voltmeters marked off in ohms.

The electro-dynamometer instruments are built with a fixed coil and a movable coil; the fixed coil being in series with the apparatus whose resistance is to be determined, while the movable coil is connected across its terminals.

The voltmeter instrument must be supplied with

Fig. 1. The Megger.

a constant voltage (a condition which is practically almost impossible to obtain) and then a given instrument is available over only a very moderate range.

It must be partly because of the difficulty found in the design of a good instrument for direct resistance measurement that so little has been done in the past in the way of producing one, while nothing has been done in planning one for the direct measurement of dielectric or of insulation resistance. The very fact that no instrument has been available for measurements may give the reason why so little real knowledge of insulation and insulation resistance has been gained.

It is true that a voltmeter can be used in an indirect way, and is used very extensively in telephoning engineering, for determining insulation resistance. But it is not direct reading; changes its indication with

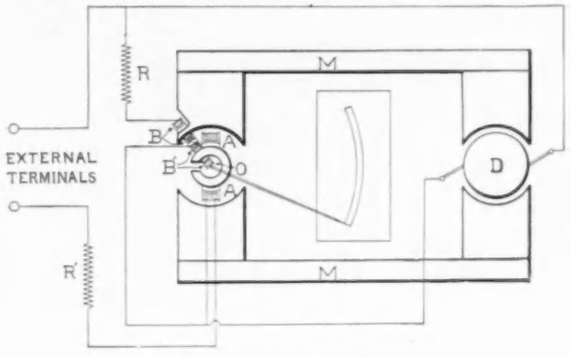


Fig. 2. Diagram of the Megger.

the amount of E.M.F. in use; for a given change in resistance the change in scale reading is very different at different points along the scale; at the lower end of the scale where the needle stands for most observations of insulation resistance the inaccuracy of a determination is very great. Besides all this, the person having insulation measurements to make on telephone systems seems commonly to have very curious ideas of what he is doing when making them by the aid of a voltmeter, and no notion at all of what the real insulation is or ought to be. Furthermore, for cable testing and all sorts of work where insulation resistance is important and no constant source of E.M.F. like the storage battery of the central office is available, it is necessary to carry a bulky equipment of cells and voltmeter if insulation resistance tests are to be made at all.

Ten, or a dozen years ago, Mr. Sidney Evershed, after much experiment with ohmmeters of a fixed coil type, turned his attention to the development of a portable ohmmeter for high resistance measurements which would have moving coils only and include the valuable features of permanent magnet instruments. Some four years ago the perfected instrument (the Evershed megger) was put on the market. The megger has a dead beat movement and greatly increased sensibility above that of former ohmmeters. It is available in standard instruments in various ranges between 1,000 ohms and 2,000 megohms.

The megger complete and ready for use is illustrated in Fig. 1. This shows the instrument, one-sixth of full size. The insulation resistance to be investigated is connected between the binding posts, one of which is marked "line" and the other "earth." The crank is turned at fair speed and the amount of insulation resistance in megohms read from the scale.

The whole process requires a few seconds; the operation can be conducted by anyone; the results have an accuracy usually considerably higher than that obtainable with other apparatus available for such measurements. The megger is portable, weighing about twenty pounds. It is self-contained. It is not affected in any way by its surroundings.

In Fig. 2 is shown diagramatically the arrangement of the interior parts. Figs. 3 and 4 show the

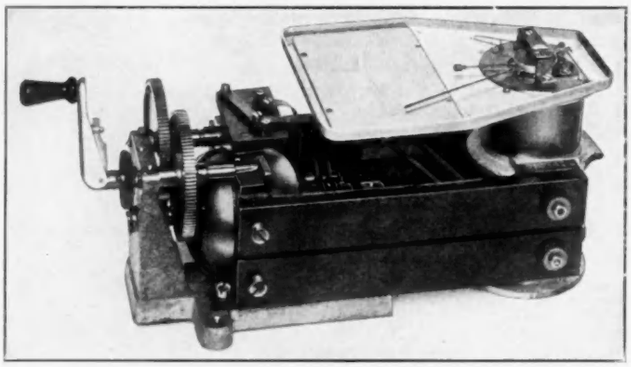


Fig. 3. Interior of Megger.

interior construction and the moving system respectively. Referring to Fig. 2 we see that permanent magnets *M M* are so arranged that a closed magnetic circuit is formed. In this magnetic circuit at one end a pair of pole pieces are placed, between which a dynamo armature revolves. At the other end is another pair of pole pieces, within the field of which the moving system works. The dynamo, driven by the crank placed as shown in Fig. 1, furnishes the E.M.F. by means of which the instrument operates. It may supply 100, 250, or 500 volts. Careful designing has brought the torque to be supplied for driving this machine to so small an amount that very little effort is required on the part of the operator.

The moving system is made of three coils rigidly connected to each other (see Figs. 2 and 4). Tracing out the connections it will be found that the coil *A A* of the moving system is in series with the apparatus under investigation through resistance *R'*. It is the deflecting coil and it exerts a deflecting force in the field where it is placed proportional to the current in it. Coils *B* and *B'* are connected in series. They, with resistance *R* in series, are put directly across the dynamo terminals. They constitute the controlling coil of the instrument, the amount of their restraining force being a function of the position they take. As shown in Fig. 2, the indicating needle points to zero on the scale; coil *A A* has a large current in it and coils *B B'* are exerting a maximum restoring force. Reference to Fig. 4 will show how the moving system is assembled. The current is led in and out of the coils through very slender copper ribbons which produce no torque; there are no springs; the needle takes a position determined wholly by the torque of current in a magnetic field.

The proper relation between deflecting and restoring forces is secured through the use of the D shaped iron piece within coil *A A* which may be seen in Figs. 2 and 4. It is mounted securely in place on the frame which supports the moving system.

Since it is the plan of this article merely to give an outline of the nature of the megger no attempt will be made further to describe the many details of construction which go to make the instrument the reliable piece of apparatus it is. The fact that it is an instrument of the moving-coil-permanent-magnet type gives it all the good points which belong to this class, while being an ohmmeter it is even more constant in calibration. For some purposes the variable E.M.F. derived from the dynamo operating at various speeds is very useful; for cable testing (on account of the capacity present) it is bad. For the last sort of testing, therefore, a constant pressure megger is made. In it a friction clutch is interposed between the last gear and the dynamo armature, so contrived that when operated above slipping speed the E.M.F. is constant within negligible limits.

Among the many direct applications of insulation resistance measurements one or two may be mentioned. Periodic examination of apparatus for insulation resistance, as is done so readily with a megger, will reveal depreciation whether due to moisture or to the development of some permanent defect. A skilled observer can even tell from the behavior of his megger whether the fault is due to moisture or proximity of conductors, for example.

Meggers are also supplied in such form that by throwing a simple switch the instrument, along with an acessory rheostat, becomes a bridge megger. That is, a megger available for all sorts of Wheatstone bridge work, including Varley loop tests. For the last named purposes it has some merit in using so considerable an E.M.F. that contact potential differences existing at faults or along lines become nearly or

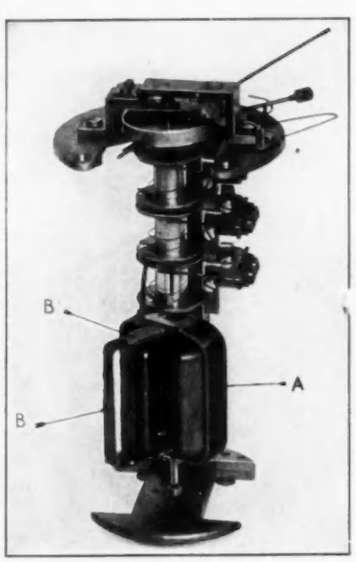


Fig. 4. Moving Parts of the Instrument.

wholly negligible. For general work the bridge rheostat has points of special merit. American users have pronounced it the most rapid rheostat made. Under test by well-known American engineers, the bridge megger when used for measurements between one ohm and a megohm shows a high accuracy; as high as the best American-made testing sets. The accuracy of the megger, also, is limited only to the accuracy with which the scale can be read.

The Law and the Telephone

By E. J. Wenner

NECESSARY TO OBEY ORDER OF COURT.

BRECKENRIDGE JONES, president of the Mississippi Valley Trust Company of St. Louis, Mo., had been cited to appear before Justice Benton to give evidence in the case brought against the directors of United States Independent Telephone Company, but failed to obey the summons. Justice Benton issued a bench warrant for Mr. Jones and he was brought from his summer home to the court. He was able to give a satisfactory excuse for his absence, giving as his reason that he had been advised that the attachment would be vacated on account of an irregularity and on that account assumed that his attendance in court was not necessary. He was able to satisfy the court that he had no intention of absenting himself at a time when he was wanted as a witness and the court refrained from punishing him for his non-appearance.

It appeared from the evidence of Mr. Jones that his trust company was not a party to the proceedings in which the directors of the United States Independent Telephone Company were involved. He admitted, however, that he had invested $25,000 in the telephone company, and had signed an agreement to take $150,000 more of the stock should the company be unable to sell it to the others. Quoting him, he said, "I invested my money in a business enterprise, believing in its merit, the investment resulted disastrously, and I lost money along with others who had invested."

RIGHT OF TELEPHONE COMPANY TO DISCONTINUE SERVICE—NOT DUTY OF COMPANY TO SEND COLLECTORS FOR RENTALS.

Where a telephone service contract is renewable each month on payment in advance of a stipulated sum, it was held the service might be discontinued without liability on the part of the company, if no payment is made or tendered in advance.

The plaintiff, Luckett, is a veterinary surgeon and his telephone had been removed because of his having been six months in arrears for rentals. Luckett claimed damages, both actual and exemplary, alleging that he had lost ten different patrons because of the removal of his telephone instrument. He also claimed the removal of his telephone instrument was unwarranted and malicious, and upon these charges based his claim for exemplary damages.

It was shown at the trial that when the lineman came to remove the instrument Luckett, or someone for him, offered the lineman the back rental. The court decided that the company had the right to discontinue his service for failure to pay according to regulation, and his failure to pay back rental, and also that Luckett's offer to pay the lineman when the instrument was being removed was ineffectual for the reason that the lineman was not authorized to receive money for the company.

It was also held in this case that the company was not required to send its collector to plaintiff's stable to collect the rental, and that the fact that it sent collectors to some houses was no reason why it should pursue the same course as to all.

The court specificially held that there was no showing of fraud such as would justify a finding for exemplary damages.—*Southwestern Telephone and Telegraph Company vs. Luckett*, 127 *Southwestern Reporter*,

FRANCHISE RIGHT CAN NOT BE COLLATERALLY ATTACKED.

A telephone company operating under a franchise within the limits of a city has no right to collaterally attack the franchise rights of a competitor for failure to comply with the terms of the franchise given at the time of the establishment of the competing system, such right of attack being given to the city only.—*Hook vs. Bowden*, 812 *Southwestern Reporter*, 261.

SEEK TO MODIFY INJUNCTION.

In the case in which the state of Nebraska has secured a restraint order, restraining the Nebraska Telephone Company from purchasing competing lines in the state of Nebraska, and from connecting with the plants recently purchased at Plattsmouth, Nebraska City and Papillion, the defendant filed a motion to modify the restraining order in such a manner as to allow the defendant to connect its toll lines with the plants at the above mentioned cities.

Mr. E. M. Morsman, Jr., made the opening argument for the Bell Company. He argued that the three plants in question were acquired in order to keep the Bell Company from being shut out of the territory. He claimed a willingness on the part of the Bell people to allow these parties to operate in connection with independent toll lines, but urged that they be allowed to connect with the Bell line and that the Bell lines be allowed to connect with them. Mr. Morsman argued that these lines were not competitive even though they ran parallel between certain points. He claimed that over 85 per cent of the toll business is handled from subscribers' stations, and that unless his company has connections with the independent stations it will not get its share of long distance business. Mr. Morsman argued that a temporary connection would injure no company and do no irreparable injury, and would not act as a restraint upon the court if it should finally decide to make permanent the injunction prayed for. He claimed the activity of the Bell Company was resulting in a benefit to the company and not an injury and that people of the state had no complaint to make.

Mr. Byron Clark, who argued for the Bell Company, prefaced his remarks by saying that he had organized an independent telephone company and that he knew something of the "tricks and artifices of the independents."

He asserted that as soon as the attorney general had made application for the injunction telegrams were sent out by independent officers advising local managers to send congratulatory telegrams to the attorney general. In referring to the independents he used the following language ,"They are the buccaneers in the telephone business in this state."

He argued that the owners of stock in these companies had a perfect right to sell it and that the corporate entity was preserved, and that the company still owed certain duties to the public which had been in no way changed since the Bell people had acquired the majority of the stock. He claimed that when the court granted the temporary injunction it violated private contractual

relations and compelled the Bell Company to do business with the independents. He asserted that the writ of injunction had broken the contracts of one subject of the state at the request of another.

The case was argued in the Superior Court of Nebraska on September 12 and 13 and was taken under advisement.

PHYSICAL CONNECTION LAW EXPECTED IN NEBRASKA.

It is not improbable that the next legislature of the state of Nebraska will have an opportunity to enact a law compelling telephone companies to physically connect their exchanges so as to allow connection between the subscribers of the different companies. The arguments in the Supreme Court of Nebraska in the case of the State vs. Nebraska Telephone Company, in which it was sought to modify the existing injunction against the Bell Company, brought forth many suggestions for the future government of telephone companies in that commonwealth. It is not improbable that the legislature will enact certain laws requiring connections between telephone companies, the same as freight connections are now required between railroad companies. Many of those interested desired the law to be so phrased as to allow the subscriber to determine over which of two or more lines his calls shall be routed.

THREE HUNDRED THOUSAND DOLLAR INFRINGEMENT SUIT.

C. H. Parschall of St. Louis, Mo., has brought suit for $300,000 against Kinloch Telephone Company for infringement of his patent.

Mr. Parschall claims to have purchased from H. A. Bennett, an inventor, all rights in and to the invention by which a central exchange operator may ring one telephone on a party line without ringing any of the other telephones. Before the invention of this device it was necessary to ring one, two, three or more rings to designate which telephone on the party line should answer.

Mr. Parschall asserts that he will bring suit against every telephone company in the United States that uses this device. This will include practically every telephone company in existence.

DELAY—DAMAGE BY FIRE.

Plaintiff was awakened shortly after 1:30 o'clock a. m. and discovered his factory afire.

He went to the telephone connected with defendant's system, of which he was a subscriber, and took down the receiver to give a fire alarm. No one responded, though he called for central and worked the receiver for nine or ten minutes. He then handed the receiver to his wife, who got the connection in one or two minutes. On turning the receiver over to his wife, plaintiff went to the factory, and from there started to the fire department, which had a station four and one-half blocks away. He met the hose cart on the way; the department having been called by a neighbor. The firemen were on the scene a minute and a half thereafter, but at that time the fire was beyond control. There was no proof when the fire passed beyond control, nor whether intervening acts might not have prevented the firemen from saving the building had they been warned of the fire at that time, and endeavored to do so. Held, that the destruction of plaintiff's building and machinery was not direct proximate result of the negligence of defendant company in failing to provide prompt connection, and that defendant was not liable for the loss sustained.

Under the Iowa statutes negligence on the part of telephone companies is presumed when there is unreasonable delay, etc. *Held,* that the delay as applied to a telephone company contemplates a failure to furnish a proper connection within a reasonable time as well as in otherwise transmitting messages, so that, on plaintiff showing an unreasonable delay on the part of the defendant the burden was on him to establish by a preponderance of evidence that the delay was not due to its negligence.—*Volquardsen vs. Iowa Telephone Company (Iowa),* 126 *Northwestern Reporter,* 928.

DISCRIMINATION IN RATES.

A telephone company was not entitled to charge a telegraph company a greater rate for service than it charged other business houses for similar service, because the telegraph company derived a greater profit from the use of its telephone in the receipt and delivery of telegraph messages, since the rates chargeable by the telephone company depend on the character of its service rendered, and not the value of the service to the customer.

That a telephone company also furnished telegraph service, did not authorize it to charge discriminating rates for telephone service furnished to a competing telegraph company, in order to enlarge the profits derived from the telegraph part of its business.—*Postal Telegraph Cable Company vs. Cumberland Telephone and Telegraph Company, U. S. Circuit Court, Middle District of Tennessee,* 177 *Federal Reporter,* 726.

WAIVER OF FORFEITURE OF FRANCHISE.

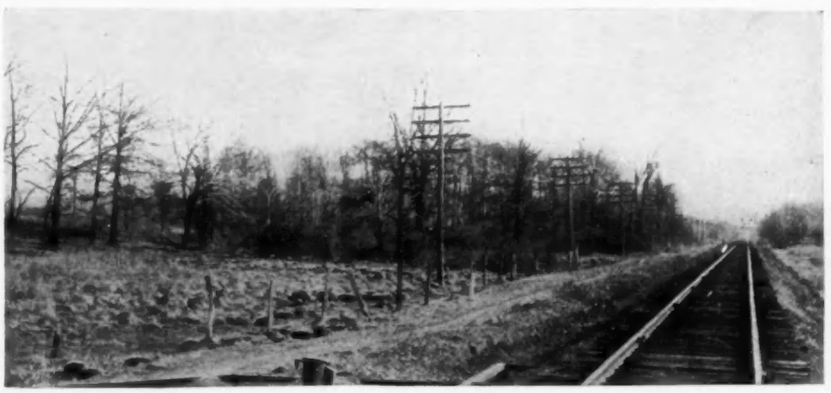
Where a municipal ordinance granting a telephone franchise provided that it should be void if the grantee had not established and put in operation the telephone exchange within six months after acceptance of the franchise, and this was not done, but the city council by resolution extended the time and the grantee commenced the construction and establishment of the telephone system, the forfeiture was waived by the city.

A grantee of a telephone franchise will not be enjoined from establishing his telephone system for failure to comply with the terms of the franchise as to the time for its establishment, since a court of equity will not enforce a forfeiture, though the case may be one in which no equitable relief would be given to the defaulting party against the forfeiture.—*Hook vs. Bowden (Missouri),* 128 *Southern eRporter,* 261.

Organize Asssociation of Telephone Officers.

At a dinner, at the Ohio club, of officers connected with the Bell telephone companies of Ohio, the Ohio Bell Telephone Society was organized and will include all officials connected with the Bell telephone companies in that state.

The objects of the organization are the cultivation of closer social and working relations between the officials of the companies, and also to hear addresses and papers by telephone experts on topics of interest. The society has been promised the presence of the leading telephone men of the country at its meetings and much is expected of the new organization. Its meetings will be held on the third Monday night of each month, in Columbus, and already its membership embraces Cleveland, Toledo, Akron, Dayton and Columbus. Rollo R. Stevens of Columbus, was elected president, James T. Daniels, secretary, and A. S. R. Smith, J. F. Druckenmiller and H. C. Shearer, members of the executive committee.



DEPARTMENT of RAILWAY TELEPHONES

Dispatching on Steam and Electric Lines

By C. P. Button

THE method of handling trains on our American railways has remained pretty much the same since our early days, so far as concerns the orders by which they had been governed and the means of transmitting these orders.

Hesitation was shown in accepting the telegraph as a means of transmitting train orders, but its adoption was inevitable in consideration of its apparent advantages. A very great need of it existed and an official of the Erie Railroad braved criticism and tried it out, with the result that it gradually came into general use.

The movement of thousands of trains was thereafter governed by telegraph train orders, the single order system being in use. There are many of the old time train dispatchers today, who still have a lasting regard for the single order system. This is based upon their ability to demonstrate their capacity for train handling with the single order system to a greater extent than, they claim, is possible with the double order system.

A dispatcher using the single order system would issue a holding order at some point thirty or forty miles from a terminal, and it was surprising how many train movements could be made on such a holding order before the different trains would finally close up in common territory where specific meeting points would be determined. The double order system, however, had little trouble in completely superseding the single order system, for it was a most logical argument that if both or all trains concerned in a certain movement received the same order, there should be little chance of misunderstanding.

The adoption of the telephone for transmission of train orders on steam railways was largely influenced by the complete success demonstrated in this direction by the electric interurban operators. This was another stride of progress, which required the finding of someone who had the courage of his convictions in regard to the value of the telephone for this use. The electric railways promptly fathered the movement for transmitting train orders. The wisdom of their action is evidenced by the fact that about 30,000 miles of steam railways are even now being operated under orders transmitted by telephone, yet the first general movement in this direction in the steam railway field dates back hardly two years.

There is no question but that the telephone is preferable to the telegraph for train dispatching purposes. It gets the men better organized for the work in hand. Everybody on the division is in speaking distance with each other, as it were; for the conductor can step to the telephone and tell the dispatcher first hand just what situation confronts him, the engineer can tell the dispatcher just what he is "up against." It's "dollars to doughnuts" the situation will be found to look a whole lot different when explained by word of mouth instead of by a brief message.

Reinforcement to man's memory is essential in railroad work, for ofttimes the most trusted employee will receive orders to meet a train at a certain siding, thoroughly understand them, and have every intention of obeying the instructions; something, however, would momentarily divert attention at about the time when the designated siding was being approached and the unfortunate fellow would go by that siding and into the other train, head-on. Just suppose now that the dispatcher, instead of relying on instructions alone, had set a signal to "danger" at that siding before he issued the meeting order.

The writer issued orders on a certain occasion for two trains to meet at a designated point. One of the crews overlooked their hand, and—well, it's the same old story, two mighty forces approaching each other on the same track, no thought of turning back. After quickly and carefully sizing up the situation, I

Department of Railway Telephones

This department is established as a permanent feature of Telephone Engineer. The progress of the art of telephone train dispatching, its technical developments, its news, and the elucidation of its mysteries for the non-technical worker will be found each month in these pages. The editors invite the problems and solicit the co-operation of the many readers of Telephone Engineer in all parts of the world whose interests lie along these lines.

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had the following facts to ponder over; here was a comparatively light train threading its way swiftly around sharp curves up a heavy grade and ten miles away was a train with fifty carloads of coal drawn by two engines coming down a heavy grade toward the first train.

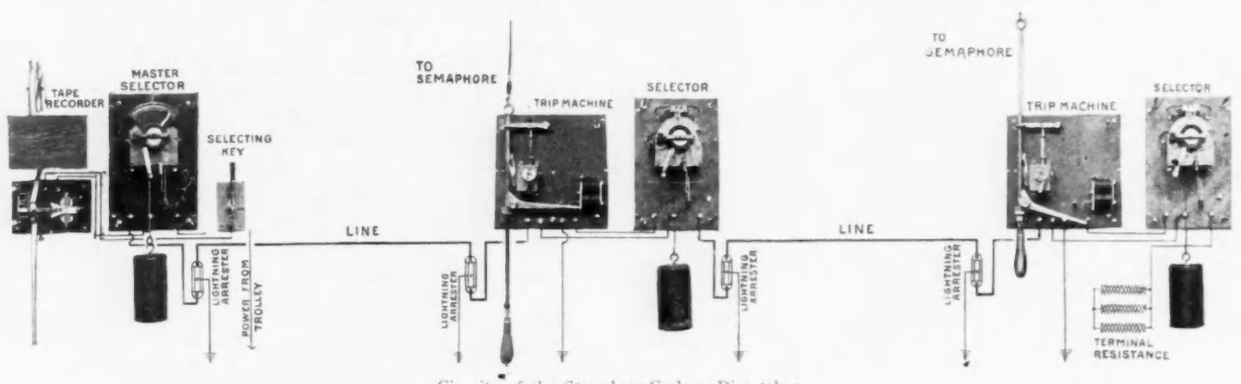
I tried to find some farmer near the right of way who had a telephone, but without result. There was a telegraph office midway in the ten mile stretch these trains were covering. It was only a day office though, and as this was midnight there was no reason to believe that anyone was in the office. I grabbed at the straw, thinking chance or a late party might have led the operator to the office. He was a half mile away, however, off duty and sleeping more sound no doubt than when he formerly worked nights, and that was sufficiently sound to cause comment in the dispatcher's office.

This intermediate station, by the way, was located on about the only straight stretch on the whole ten miles and was on what we call a "hog back." Either train could have shut off and the "hog back" would have stopped it at the station, as it was heavy up grade approaching the station from either direction.

It would have been a boon to the dispatcher and the salvation of the trains to have had the power to set a dispatcher's signal at "danger" at the little midway station on the "hog back." It would have been a convenience of incalculable value if immediate telephonic communication could have been established between the dispatcher and the train crews.

With the introduction of modern apparatus, the dispatcher's signal and portable telephone, it is most practical to set the signal to "danger" at the selected meeting point, then issue orders to the respective crews to meet at this point. The first crew of the two concerned, arriving at the meeting point and finding the signal set against them, will call the dispatcher by telephone and be reminded of the orders to wait there for the opposing train or interurban car.

Interurban electric railways string one bare iron line wire of No. 10 to 12 gauge, as well as a pair of telephone wires along the line. These constitute the dispatcher's signal line and the dispatcher's talking circuit, respectively. Where the Stromberg-Carlson type of selector is used, for example, the master selector and tape recorder are located in the dispatcher's office, placed conveniently on the dispatcher's desk,



Circuits of the Stromberg-Carlson Dispatcher.

It was just a fair deduction that led me to tie up my other trains at watertank stations; tell the yard master at terminals to call no more crews for the road; order the wreckers out from both terminals; call engine and train crews to man the wreck trains; get the crew nearest to the danger zone to side track their train and have their engine next to caboose ready to take the two town doctors to the aid of the injured if needed; get a messenger started for the doctors, provide for a clear track for the wreck trains and call every section foreman and gang that could be reached at that hour of the night; notify the superintendent, the chief dispatcher and the master mechanic, for, of course, the master mechanic would be interested when it came to making the proper hitches on the big iron monsters lying bottom side up down the bank. That this deduction and the action taken was warranted, was soon evidenced by the fact that the train wire soon showed a dead ground at some point in the ten mile stretch. Things ran in fifties that night. I had to wait fifty minutes for the uninjured to find the operator's home and report the facts, while the company had to kiss good-bye to $50,000 which had only been flirting with the treasury. Two conclusions are naturally drawn from this wreck.

and the companion selector is located at each station or siding. These selectors are connected with the semaphore at each station and are under absolute control of the train dispatcher. The dispatcher desiring to set the signal to "danger" at any point simply throws a controlling switch, giving battery to the line. The effect of this battery current is to energize a magnetic coil causing an armature to pull up and release the driving wheels of the clock movement at each of the stations. The wheels in all of the stations are rotated at the starting position by suspended weights and occupy the same relative position and the clock movements beat at the same time.

The dispatcher then moves the controlling switch to the next position and the battery current through the line is broken. This allows the magnets in the selectors to release their armature, so that the friction wheel comes into contact with the moving wheels or discs. As all clock movements are in operation, the contact carrying discs continue to move together and pass over the contacts of the various stations in the order of the stations until the indicator or master selector comes into contact with a plug which has been inserted in the dial hole corresponding to the local station where the dispatcher intends to set the signal

to "danger." At the instant the moving hand of the master selector comes into contact with the inserted plug, the corresponding local station selector has moved the contact carrying disc into contact with the springs and completed the circuit through the trip mechanism. The trip is operated, releasing the semaphore and also cuts itself from the circuit. At the same time a circuit is closed which permits the answer back mechanism to send back the telltale impulses for the dispatcher's tape. The semaphore reaching the full danger point automatically sets the answer-back mechanism in operation and at the same time the moving disc of each clock is restored to the starting position, leaving every selector ready for further selections.

The diagram shows the arrangement of the Stromberg-Carlson Telephone Manufacturing Company's dispatcher's signaling apparatus, which is selected as a type of interurban equipment. With such a system the dispatcher can within a few seconds' time halt car or train at any station or siding for any purpose and communicate with the crew.

A Study of Telegraphic Transmission

By Frank F. Fowle*

THE present practice in telegraph line construction has largely standardized certain sizes of copper and iron wires, and these sizes are used to a large extent without any predetermination of what size or material is most economical in a particular case. Hard drawn copper, of No. 9 Brown & Sharpe gauge, weighing 209 pounds per mile and B. B. iron, of No. 8 Birmingham gauge, weighing 378 pounds per mile, are the standards now most generally employed. A comparison of copper-clad steel wire with these standards, on a basis either of equal conductivity or equal tensile strength, would not be conclusive, because a proper comparison must take into account the necessary properties of the line conductor, both mechanical and electrical, in relation to the length of the line, the system of transmission and the efficiency of the office equipment. Extensive consideration has therefore been given to the theory of telegraph transmission, in order to determine the requisite properties of a line conductor to give satisfactory service over a line of any stated length. This theoretical study establishes a method of predetermining the necessary characteristics of the line conductor in any given case. It has been deemed advisable to present this portion of the investigation in sufficient detail to enable anyone, who so desires, to verify the deductions.

The working efficiencies of different types of telegraph relays have an important relation to the problem. The use of inefficient relays causes a material increase in the cost of the line, which greatly exceeds any saving ordinarily effected in the cost of the equipment. This phase of the investigation has received careful attention and the standard types of relays have all been tested to determine their limits of operation. Having given the properties of iron, steel, copper and copper-clad steel wires, it then becomes possible to compare their economies for a line of any particular length, with a given kind of transmission.

The systems of transmission employed in modern telegraph practice may be divided broadly into two classes: The first is the Morse system, which has survived since the early days of the art, with few modifications; the second comprises the high-speed automatic systems, of which there are many in existence, but few in use in this country. Excepting a few instances of long haul transmission between large cities, the Morse system is practically in universal use. High-speed automatic systems, such as the Buckingham, the Baudot and the Rowland, have found considerable favor in Europe. They are best suited for through circuits between large traffic centers, and do not economically meet the conditions in short haul or local service.

The predetermination of the required conductor properties, for a line of any given length, depends in part upon the system of transmission employed. The character of the line signals in automatic systems is usually complicated in comparison with Morse transmission, and no two automatic systems employ exactly similar transmission and equipment. Therefore, it would greatly extend the time spent in this investigation to compare iron, steel, copper and copper-clad steel for each of the automatic systems now in use. Furthermore, this use is now inextensive, and therefore the present investigation has been confined to the standard Morse system, which is in such general use in this country.

For convenience in studying this report, a synopsis of the contents and treatment is given here.

I. PROPERTIES OF TELEGRAPH LINES:—*Resistance, inductance, capacity, leakage.*

II. TRANSMISSION EFFICIENCY:—*General theory, simplex working, duplex working, quadruplex working.*

III. RELAY TESTS:—*Standard type, polar type, neutral type.*

IV. LINE CONDUCTIVITY REQUIREMENTS:—*Simplex working, duplex working, quadruplex working, summary.*

V. TENSILE STRENGTH REQUIREMENTS:—*Sleet and wind loads.*

VI. PHYSICAL PROPERTIES OF LINE WIRE:—*Iron and steel, copper, copper-clad steel, summary.*

VII. COMPARATIVE ECONOMY OF COPPER, IRON AND COPPER-CLAD STEEL.

VIII. EXPERIENCE WITH COPPER-CLAD STEEL.

IX. CONCLUSIONS.

1. THE PROPERTIES OF TELEGRAPH LINES.

All electrical transmission lines possess in common the following properties:

1, Resistance; 2, Inductance; 3, Capacity; 4, Leakage.

These four properties determine the electrical efficiency of any transmission circuit. Their relationship to the efficiency depends upon the kind of transmission considered, and in any given case the efficiency depends further upon their absolute and relative magnitudes. These properties will now be considered in order.

Resistance.—The property of resistance is generally well understood. It varies directly as the specific resistance of the material, inversely as the cross-sectional area

* A report on the use of copper, iron and copper-clad steel wires in telegraph service, made to Frank R. Chambers, Jr., vice-president of the Duplex Metals Company, August 1, 1910.

of the conductor and directly as the length of conductor. The unit of resistance is the international ohm; in dealing with very large resistances a unit of one million ohms, termed the megohm, is generally employed.

The specific resistance is commonly stated as the resistance between opposite faces of a cube of unit dimensions; it is also stated as the resistance of a wire one mil (.001 inch) in diameter and one foot long. In the latter case the resistance of any size and length of wire is given by,

$$r = \frac{r^1}{d^2}\, l \tag{1}$$

where r^1 = the resistance of the mil-foot, d = the diameter of the wire mils, l = the length of the wire in feet.

As the resistance of telegraph wires is commonly stated in ohms per mile, the formula to express this would be

$$r = 5{,}280\, \frac{r^1}{d^2} \tag{2}$$

The resistance of iron, steel and copper increases with the temperature. The relationship between resistance and temperature is expressed by the formula,

$$r = r_o\, (1 + a\, t) \tag{3}$$

where r_o = the resistance at zero temperature, r = the resistance at the temperature t, a = a constant, which has different values for different metals.

This formula gives the average between resistance and temperature; the exact formula as given by Matthiessen and others is less simple, but it is not necessary to employ it in this work. The value of a may be taken as follows:

$$\text{For iron, } a = .0048 \tag{4}$$

$$\text{For copper, } a = .0042 \tag{5}$$

All authorities are not agreed upon the value of a for copper and it is variously given from .0040 to .00428. Dr. Perrine gives .00406, while the standard of the American Institute of Electrical Engineers is .0042. The variation is the purity of the samples from which the constant was determined is undoubtedly responsible in part for the discrepancies.

In discussing the resistance property much use is made of the term conductance, which is the reciprocal of resistance. The unit of conductance is the mho, or the reciprocal of one ohm. The relationship is expressed by

$$g = \frac{1}{r} \tag{6}$$

where r = resistance in ohms, g = conductance in mhos.

Copper-clad steel wire is a compound wire having a cylindrical steel core with a substantially uniform coating of copper. Its resistance is therefore intermediate between that of steel and that of copper, depending upon the relative proportions of the metals. The effect of different proportions will be discussed briefly. The conductivity of a copper-clad steel wire in terms of that of a copper wire of the same diameter is found as follows:

The proportion of copper by weight in a compound wire is given by

$$n = \frac{\pi\, (r_2^2 - r_1^2)\, s_2}{\pi\, r_1^2\, s_1 + \pi\, (r_2^2 - r_1^2)\, s_2}$$

$$n = \frac{(r_2^2 - r_1^2)\, s_2}{r_1^2\, s_1 + (r_2^2 - r_1^2)\, s_2} \tag{7}$$

where r_1 = radius of steel core, r_2 = radius of wire, s_1 = specific gravity of steel, s_2 = specific gravity of copper.

And it follows that the proportion of total cross-sectional area occupied by steel is

$$A_s = \frac{r_1^2}{r_2^2} = \frac{(1 - n)\, s_2}{n s_1 + (1 - n)\, s_2} \tag{8}$$

The proportional area occupied by copper is

$$A_c = 1 - \frac{r_1^2}{r_2^2} = \frac{n\, s_1}{n\, s_1 + (1 - n)\, s_2} \tag{9}$$

The conductivity of the compound wire in terms of a copper wire of the same diameter is

$$\rho = \frac{\pi\, r_1^2\, u + \pi\, (r_2^2 - r_1^2)}{\pi\, r_2^2}$$

$$\rho = 1 - (1 - u)\, \frac{r_1^2}{r_2^2} \tag{10}$$

where u = the ratio of conductivity of steel to copper.

Hence
$$\rho = 1 - (1 - u)\, A_s. \tag{11}$$

And by substituting (8) in (11) it will be found that

$$\rho = \frac{n s_1 + u\, (1 - n)\, s_2}{n s_1 + (1 - n)\, s_2} \tag{12}$$

The following values of specific gravity will be used:

$$S = 7.85 \tag{13}$$

$$S = 8.89 \tag{14}$$

The conductivity of steel varies with its composition and treatment. B B iron wire is manufactured from a grade of mild steel and has a conductivity equal to 16 per cent of that of hard drawn copper wire. The grade of wire known as steel has a conductivity equal to 14 per cent of that of hard drawn copper. These conductivities are based on Roebling's tables for iron and steel telegraph wire.

The catalogue properties of copper-clad steel wire show an average conductivity equal to 40.8 per cent of hard drawn copper, and the proportion of *steel by weight* is given as 60 per cent. Assuming that the proportions of copper and steel are 40 per cent and 60 per cent respectively, the conductivity will be as follows for different values of u, computed from (12):

VALUES OF u.	VALUES OF ρ.
10 per cent.	43.3 per cent.
12 per cent.	44.6 per cent.
14 per cent.	45.9 per cent.
16 per cent.	47.1 per cent.

This table shows there is normally a margin in conductivity above the catalogue values, upon the preceding assumption. It shows also that the proportion of copper by weight may fall slightly below 40 per cent without reducing the conductivity below the catalogue values. It is impossible to prevent some slight variation in the commercial wire, as to conductivity and proportions of copper and steel. Therefore, if the average proportion of copper is 40 per cent, there is a considerable margin to protect a rated conductivity of 40 per cent.

The temperature coefficient of resistance change with temperature has not yet been accurately determined. It might be expected that it would be intermediate between the coefficients of copper and steel, but this is not apparently the case. A report of a test by the Electrical Testing Laboratories of New York, N. Y., to determine the resistance and impedance to alternating currents of low frequency, shows approximate coefficients per degree Centigrade as follows:

B. & S. GAUGE.	VALUES OF COEFFICIENT.
No. 6	.0035
No. 8	.0019
No. 9	.0016
No. 10	.0023
No. 12	.0018
No. 14	.0016
Average	.0021

The exact explanation of this result cannot now be given, but it is reasonable to believe that the normal structures of copper and steel have been changed in the process of manufacturing the wire. This applies more especially to the steel.

In telegraph practice the term mile-ohm is very convenient and frequently employed. It is defined as the weight in pounds of a wire one mile long, whose resistance is one ohm. By means of this quantity the weight of a wire having any desired resistance per mile can be found at once from the formula.

$$w = \frac{W}{r} \qquad (15)$$

where W = weight of the mile-ohm in pounds, w = weight in pounds per mile, of a wire having a resistance of r ohms per mile.

The value of the mile-ohm is constant for any given

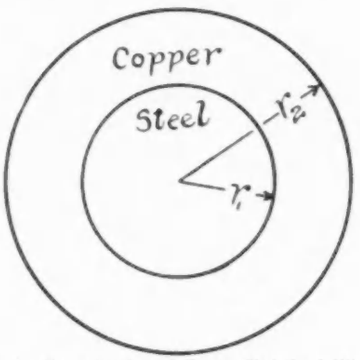


Fig. 1. Cross Section of Copper-Clad Steel Wire.

temperature. The mile-ohm of copper-clad steel as determined from the catalogue weights and resistance is 1,991 at 60° F. Taking the value of a in formula (3) as .0021, the mile-ohm at 68° F. would be 2,010. The following table gives the value of the mile-ohm for various kinds of wire at 68° F. (20° C.):

MATERIAL.	MILE-OHM.
E. B. B. Iron	4,700
B. B. Iron	5,500
Steel	6,500
Hard Drawn Copper	895
Copper-clad Steel	2,010

The mile-ohm for iron and steel wire is taken from Roebling's tables for telegraph wires. The mile-ohm of copper is based on a value of 826. at 0° C. with a temperature coefficient of .0042.

Inductance.—The property of inductance arises from the fact that about every wire transmitting an electric current there is a magnetic field. For long straight wires this field exists in concentric whirls of magnetic flux about the conductor, in planes perpendicular to the conductor axis. The inductance has no effect upon steady continuous currents, flowing in accordance with Ohm's law. Its effect upon variable or fluctuating currents is to retard them. When a circuit is closed which contains only simple resistance, the current rises to Ohm's law value instantaneously; the effect of adding inductance is to delay or prolong the rise to Ohm's law value, making it gradual. When the circuit is broken, the effect of inductance is to prolong the fall of current from Ohm's law value to zero. This refers to circuits energized by steady continuous electro-motive forces. Inductance in combination with both capacity and resistance produces more complicated effects, which will not be discussed here.

The expression for the inductance of a single copper wire circuit, with earth return, is

$$*L = .0000805 + .000741 \log. \frac{2h}{r} \qquad (16)$$

where L = inductance in henries per mile, h = height of the wire above the earth, in inches, r = radius of the wire, in inches.

For iron and steel wires the inductance is expressed by

$$*L = .0000805\,\mu + .000741 \log. \frac{2h}{r} \qquad (17)$$

where μ = magnetic permeability of the iron or steel.

The total inductance is divisible into two parts, one part comprising the inductance within the wire and the other part outside of the wire. The latter part is the predominant portion, as appears from the following calculation for a No. 9 B. & S. guage copper wire 20 feet above the earth:

Exterior inductance.	.00269
Interior inductance.	.00008
Total inductance.	.00277 henry per mile.

For an iron wire with a permeability of 100, and of the same diameter, the result is:

Exterior inductance.	.00269
Interior inductance.	.00805
Total inductance.	.01074 henry per mile.

The interior inductance of the copper wire, in the case given, is only 3 per cent of the total; for the iron wire it amounts to 75 per cent. For a copper-clad steel wire it would be between 3 per cent and 75 per cent, but nearer the former than the latter, assuming the same value of permeability. In determining the inductance of a copper-clad steel wire it is necessary to determine the distribution of current between the copper and the steel. This is as follows:

$$I_c = \frac{A_c}{A_c + u\,A_s} \qquad (18)$$

$$I_s = \frac{u\,A_s}{A_c + u\,A_s} \qquad (19)$$

where I_c = proportion of total current flowing in the copper, I_s = proportion of total current flowing in the steel, A_c = proportion of total cross-sectional area occupied by copper, A_s = proportion of total cross-sectional area occupied by steel, u = ratio of conductivity of steel to conductivity of copper.

For a wire having 40 per cent copper and 60 per cent steel, by weight, and steel of 14 per cent of the conductivity of copper, the current distribution is,

$$I_c = 80.8\% \qquad (20)$$

$$I_s = 19.2\% \qquad (21)$$

The corresponding proportion of copper area to total area is 37.1 per cent. The complete deduction of the for-

*See Transaction of the American Institute of Electrical Engineers, Vol. XXI., page 794, "The Transposition of Electrical Conductors," by Frank F. Fowle.

mula for inductance is too extensive to present here, but the final result is:

$$L = .0000278 + .00000296\,\mu + .000741 \log. \frac{2h}{r} \quad (22)$$

The first term of this expression gives that portion of the inductance which is due to the magnetic field in the copper sheath, the second term gives that due to the steel core and the last gives the portion exterior to the wire.

A No. 9 B. & S. gauge copper-clad steel wire suspended 20 feet above the earth will then have the following inductance, computed from (*22*), with $\mu = 100$.

Exterior inductance	.00269
Interior inductance, steel....	.00030
Interior inductance, copper..	.00003
Total	.00302 henry per mile.

The total interior inductance amounts to 11 per cent of the whole, as compared with 3 per cent for copper and 75 per cent for iron of the same diameter and correspondingly equal permeabilities.

For rapidly changing currents, or for alternating currents, there is a phenomenon known as the skin-effect, which causes the apparent resistance to exceed the ohmic resistance and the apparent inductance to become less than the true inductance. This effect is caused by the fact that the elements of current which are at or near the center of the wire encounter a greater inductance than those which are nearer the surface. For steady continuous currents of Ohm's law values, the current distribution over the cross-section, or over the cross-section which is composed of homogeneous material, is uniform. But when the current is rapidly changing, the density is least at the center and greatest at the surface, thus causing the resistance to increase and the inductance to diminish. This effect causes a greater proportional change in the resistance than in the inductance, for the latter is affected only as regards the inductance which is due to the magnetic field within the wire, while the exterior portion remains unchanged.

The skin effect will be more prominent in a copper-clad steel wire than in one of bare copper, because the inductance of the steel core will nominally be much greater than that of the copper coating. The effect is not so important as might at first appear, however, because the steel core has only 19.2 per cent of the full conductivity of the wire. Should the current be wholly excluded from the core, but remain uniformly distributed in the copper, the apparent resistance would exceed the ohmic resistance 24 per cent, but this result will only occur with extremely rapid changes of current or with alternating currents of high frequency.

Capacity.—The electrostatic capacity of suspended wires is independent of the kind of metal contained in them, and depends only upon their diameter and length. The formula for the capacity in micro-farads (millionths of a farad) per mile is,

$$C = \frac{.03884}{\log. \frac{2h}{r}} \quad (23)$$

The capacity of a No. 9 B. & S gauge wire, of iron, steel, copper, or copper-clad steel, will be .0107 micro-farads per mile. But the capacity of suspended wires, with earth return, is materially increased by the presence of other grounded wires on the pole line. Heaviside calculates that a second wire increases the capacity of a single wire 11 per cent, in a particular case, and three wires increase it 24 per cent. The maximum increase on a pole line having two or more cross-arms of wires is probably not less than 50 per cent. So that an average capacity of .016 micro-farads per mile for No. 9 B. & S. gauge is probably a fair value. The exact calculation of capacity where there are many circuits is a laborious operation and cannot be carried out in a brief time.

It should be noted that the capacity decreases as the wire diameter diminishes. This means that wherever a copper-clad steel wire is used in place of an iron or a copper wire of larger diameter, there will normally be a gain in efficiency, due to diminished line capacity.

Insulation.—The insulation of suspended bare wires is not a property of the wires themselves, but is a property of the insulators and their supports. There is probably no more important question connected with line efficiency, in Morse transmission, than the insulation, both as regards the type of insulator employed and the care given to maintaining the wires free from all foreign contacts such as limbs of trees, foliage, vines, poles, etc.

Glass has been the standard material for insulators for many years, although porcelain has been used to some extent. The present standard type is a double-petticoat glass insulator of fairly heavy proportions. Insulator types have gone through a long process of evolution and there is still considerable diversity between the practices of different companies. Of late years the progress in design and development seems to have practically stopped, presumably for the reason that more efficient insulators are considered too costly.

The insulation resistance of a well maintained line fluctuates exceedingly with the weather. Normally it is high and may range from 30 to 40 megohms per mile, or even higher. During rain-fall of considerable duration it will diminish ordinarily to a fraction of a megohm per mile. The minimum value depends greatly upon the atmospheric conditions as regards smoke and dust. Through industrial regions where there is a profusion of smoke and soot from soft coal, the minimum insulation may be only a few hundredths of a megohm per mile. Through exceptionally clean country it may never fall as low as one megohm per mile.

Franklin Leonard Pope in his treatise, "Modern Practice of the Electric Telegraph" (New York, 1892), gives the results of numerous tests upon early types of insulators. The conclusion is obvious that the double-petticoat type is greatly superior to the single-petticoat. Mr. Pope is authority for the statement that through the middle and northern states, the average insulation resistance per insulator is substantially 9. megohms. On long lines the different conditions will average themselves to some extent. I have found from actual tests that the insulation of a line of considerable length will rarely be less than .25 megohms per mile; for a line of 40 poles per mile this corresponds to 10. megohms per insulator.

The practice of some companies in following railroad rights-of-way and others in following highways, brings up two features worth mentioning. Railroad rights-of-way are naturally severe on insulation because of the smoke from steam locomotives, and the best type of insulator is needed. The atmosphere along highways is usually clean, but lines on these routes are sometimes subject to unavoidable contact with foliage, or at least it is difficult and perhaps expensive to avoid it. Railroad routes are usually much more free from this last difficulty. Very fair insulation is obtained on highway lines

using a single-petticoat insulator, but on railroad lines the double-petticoat type is the most satisfactory and economical.

The poles and cross-arms furnish considerable insulation when dry, but when thoroughly wet they add but slightly to the insulation due to the insulator alone. Some tests given by Mr. Pope show that the wet pole furnishes about 15 per cent of the total insulation. When a ground wire is carried on the pole tops, uninsulated, the insulation due to the poles will be substantially nil. The practice of installing lightning rods on about every tenth pole (four per mile) will also reduce the pole insulation materially.

The cross-arms would add somewhat to the insulation, but the effect of the cross-arm braces is to neutralize it, largely. The type of pin employed has some effect, but it is not of great consequence relatively. The wooden pin is superior to the steel pin with a wooden thimble, in this respect.

The most important factors in line insulation are the choice of an efficient type of insulator and vigilant care in maintenance to keep the lines free from foreign contacts and replace broken insulators. Low insulation is sometimes caused, also, by defective bridle cables. Inasmuch as it is the practice, especially on railroad lines, to carry the circuits into way offices at frequent intervals, for looping intermediate stations, or for testing purposes, it is important to inspect and test the office and cable insulation frequently. There is a direct and important relation between line insulation and the cost of line conductors, as will be shown in what follows.

(To be continued.)

Dispatching on the Louisville & Nashville

The spread of the telephone among the railroads in this country during the past three years for handling train movements has been remarkable. The Louisville & Nashville Railroad has already thoroughly tried out this method on some of its divisions and is now starting to equip its main line from Cincinnati with telephone apparatus.

It will not be long before the familiar click of the telegraph sounder will be missing from our railroad stations. In its place is coming the familiar telephone bell, only a much louder bell is used in railroad service. The operators at the little way stations can now be seen sitting with a receiver clasped around their heads and talking to their dispatcher in plain United States. It is no longer necessary for them to translate their fervid thoughts into a series of dots and dashes.

The advent of the telephone has brought with it better construction methods among the railroads and a safer method of handling trains. Heavy copper wires are used over which the speech is stransmitted and the circuits are so arranged that the dispatcher can call any way station along his division without signalling any other station than the one he desires.

The Louisville & Nashville has just placed an order for a complete equipment of Western Electric telephone train dispatching apparatus including selectors and telephones. This equipment will cover the Cumberland Valley and Kentucky divisions from Cincinnati to Norton, a distance of 304 miles and will consist of six circuits in all, four train wires and two message circuits with a total of 162 stations.

When this equipment is put into service, it will be possible for the dispatcher to call a way station with one slight motion of his hand and he can keep the way station bell ringing as long as he pleases. When an operator wishes to talk to the dispatcher, it is merely necessary for him to take his receiver off of the hook, press a button and speak into the transmitter. The dispatcher is connected to the circuit at all times.

With this equipment, it is also impossible for an operator to tell the dispatcher that his bell did not ring if such were not the case, because the dispatcher is given a signal that informs him whether or not the bell did ring. This has tended largely to improve the grade of service rendered.

Everywhere that the telephone has been installed, it has made good practically immediately. The saving in time has been one great advantage. The saving of the dispatchers' and operators' nerves through their being relieved of the continual handling of a telegraph key has been the feature of the new system that these men appreciate very deeply, while the ability to talk to one another by word of mouth has resulted in a closer personal acquaintance and better discipline among the men.

Another feature of the telephone which is very important to the railroads is the fact that it allows portable sets to be carried on the trains. With this equipment, if a train has been stalled at any point on the line for reasons which could not be foreseen, it is possible for the conductor to get into direct touch with the dispatcher merely by connecting his telephone set to the line with a fishing pole. The time saved by this single feature of the telephone dispatching system alone warrants its installation.

The one great essential in railroad dispatching service, a branch of railroading which is kept at the highest possible notch, is absolute safety. It is the telephone's proud boast that at the preesnt time that after three years' service, not an accident can be laid to the failure of this apparatus.

Communication from Moving Train

The Birmingham (England) *Daily Mail* of July 29 reports that a resident of that city has demonstrated the possibility of telephoning from moving trains going at express speed, reports Consul Albert Halstead. The inventor first developed an apparatus which enabled him to speak from one side of a wall through to the other, and later to send sound waves through a six-foot wall. He thereupon sought to devise an apparatus to telephone from a moving vehicle. In the course of his experiments a frame coil was attached to a motor car traveling 40 miles an hour. A wire was laid on the ground which was connected with an instrument in part of the works where he was employed. While the motor car was going at full speed induction was established between the coil on the car and the ground wire, and a telephonic conversation was carried on between the factory and the people in the car.

After this the directors of the London ,Brighton & South Coast Railway were approached, with the result that a coil of 60 feet was made and attached to an express train on that railway. Between the rails two wires were placed, and the stationary circuit was connected with the signal boxes at three bridges. Connection was made with the telephone instruments on the train, and on July 26 the apparatus was tested while the train was running at express speed.

The telephone is to be used for train dispatching on the new Oregon Trunk Railway.

Submarine Cable for Pennsylvania Lines

By A. G. Kingman

THE problem of satisfactorily caring for the numerous telephone, telegraph and signal wires necessary for the operation of a large and important railroad at points where its tracks cross a navigable river, making a drawbridge a necessity, has recently been solved by the Pennsylvania Railroad Company at its new Hackensack "draw" at the point where the Pennsylvania Terminal and Tunnel Division crosses the Hackensack river, a few miles west of Jersey City.

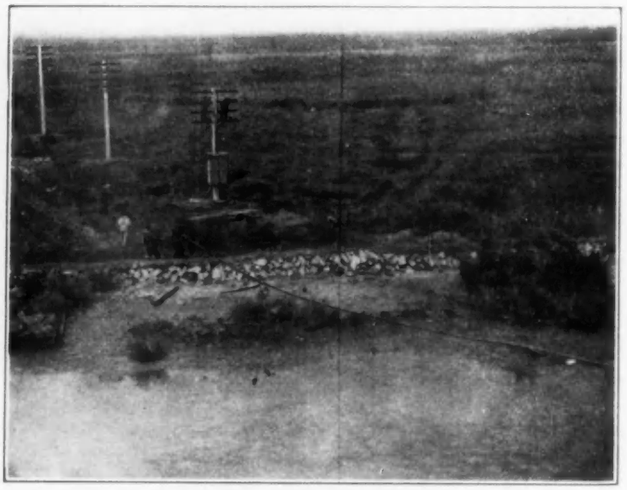
The accompanying illustrations show the laying of two submarine cables, one of 35-pair No. 13 gauge, triple wrapped paper insulation, to be used for telegraph circuits, and the other of 45-pair, No. 13 gauge, double wrapped paper insulation, having the wires of the inner core triple-rapped, and having eight pairs of this core twisted into double pairs, thus forming four phantom circuits. Each cable was 1,225 feet long, the 35-pair cable weighing eleven and a half, and the 45-pair, twelve and a half tons. Each cable had a lead sheath 5-32 inch thick. Each sheath was saturated with a non-corrosive preservative compound, over which was wound two layers of saturated jute put on in reverse directions. Over this jute was placed an armor of No. 4. B. W. G. iron wire, the armor being saturated with a preservative compound, and over this was placed two thicknesses of hemp rope, laid on in reverse directions and thoroughly saturated with preservative compound. The average mutual electrostatic capacity of this table was between .06 and .074 microfarad per mile.

These cables were made by the Western Electric Company in its dry core, paper cable plant at the Hawthorne, Ill., factory.

The work of laying these cables was done by the Postal-Telegraph Cable Company, and was under the personal supervision of Mr. M. Keily, who represented Mr. J. C. Johnson, superintendent of telegraph of the Pennsylvania Railroad.

One very interesting feature aside from the laying of the cable was the very efficient and durable line of concrete poles which terminated on either shore. These poles were cast by the railroad company in accordance with its own specifications, and it is expected that they will be found much more suitable in the low, swampy ground where they are placed than wooden poles.

Laying the Two Submarine Cables Under the Hackansack.



Cable Terminal and Concrete Poles on Shore.

The weight of this cable was such that it was not necessary to do any dredging along the river bottom, as it is expected that the weight of the cable will enable it to sink far enough into the mud to prevent its receiving any injury.

The engineers of the Pennsylvania Railroad Company, who worked in conjunction with those of the Western Electric Company, were kept busy for some time designing and developing this cable, which is the very latest product for submarine work.

Frisco Telephones in the South.

The first telephone train dispatching system ever constructed in Birmingham, Ala., was connected recently in the local offices of the Frisco Railroad. It is announced that just as soon as the connections can be made at points between that city and Jasper the system will supersede in a large degree the telegraph service now used.

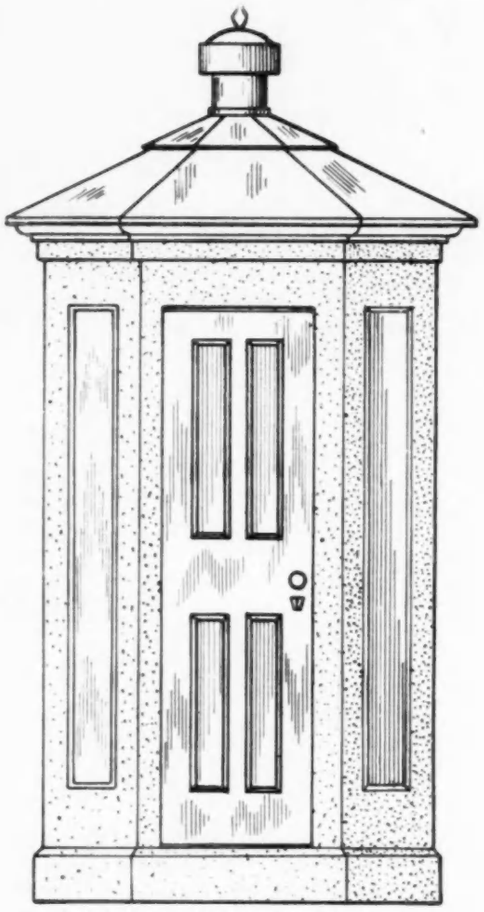
The wires have connections with every small place on the Frisco system from Birmingham to Amory, Miss. The service will, it is believed, greatly facilitate the handling of the enormous increase in both passenger and freight business which is reported on that line.

The work of installing the system has been going forward for several months. An appropriation of approximately $100,000 was made to construct the telephone lines into Birmingham.

The Frisco will not attempt at the outset to handle all business by the telephone, but will detail a sufficient volume to this service to test the efficiency to the fullest degree.

Concrete Railway Telephone Booths.

The Erie Railroad Company has had designed and is installing along its lines a neat and convenient telephone booth of reinforced concrete. The form of the booth, which is hexagonal in cross section, is indicated by the illustration. The walls, floor and roof of the structure are each four inches thick, and there is a four-inch clearance below the floor. The smallest interior dimensions of the booth are approximately three feet three inches wide and seven feet four inches high. The door is twenty inches wide and six feet four inches high, with panel and



Erie Railroad's Concrete Telephone Booth.

glass. It occupies one of the six sides; the other five sides are paneled for the sake of appearance.

The structure is reinforced with ¾-inch round iron bar and 1½-inch mesh, No. 12 gauge expanded metal. A bar is erected in each corner of the hexagon, joining a 9-inch iron ring at the top. In this ring, at the apex of the structure, is set a 6-inch "Globe" galvanized iron ventilator.

These booths are being placed at sidings along the Erie lines, and are also intended for the use of switchmen and crossing flagmen as the requirements may need.

A handsome booklet issued by the Western Electric Company deals with the subject of telephone train dispatching, and its equipment. It is profusely illustrated and should be very interesting to railroad and telephone men.

D. L. & W. Abolishes Telegraph.

The Delaware, Lackawanna and Western Railroad has entirely dispensed with the telegraph for train dispatching purposes. The telephone has taken its place. On the sixty-three miles of line between Scranton, Pa., and Binghamton, N. Y., in 1908, the first trial of the new system was made. Now the company has 271 stations equipped with the telephonic apparatus, and 2,500 miles of wire. Though experiments with telephone dispatching was started in the west, the Lackawanna is the first road to use the system exclusively over all its lines.

A great saving of time has resulted from the innovation. It is easier to summon stations along the line and calls are answered more promptly than under the former system. The whereabouts of trains and the condition of the motive power and cars in transit are known to headquarters to an extent not possible when the telegraph was used. In addition to telephones at stations and towers, there are siding telephone booths, from which train crews may communicate with the dispatcher. Under former conditions a freight train might be held on a siding for hours while waiting for a passenger train to pass it. Now the conductor calls up the dispatcher and obtains directions, possibly, to move on twenty or thirty miles further before being overtaken by the passenger train. In case a freight train was derailed or met with some other mishap, the wrecking crew always used to include a telegrapher.

"The telephone for train dispatching is not an experiment as far as we are concerned," said L. B. Foley, the Lackawanna's superintendent of telegraph and telephones. "It is a fact. Conditions are less favorable to telephone dispatching on some lines than on others, but the indications are that it will be rapidly extended, and in the end supplant the telegraphic system throughout the country."

Interurban Railway Accidents

It is generally true that when accidents occur upon interurban electric railways, either the system of dispatching or the dispatcher's equipment is at fault. Collisions upon such railroads have been distressingly prevalent within the past few weeks, a noteworthy example being the unfortunate accident on the Wabash Valley Railway, details of which have been given at length in the newspapers of the country.

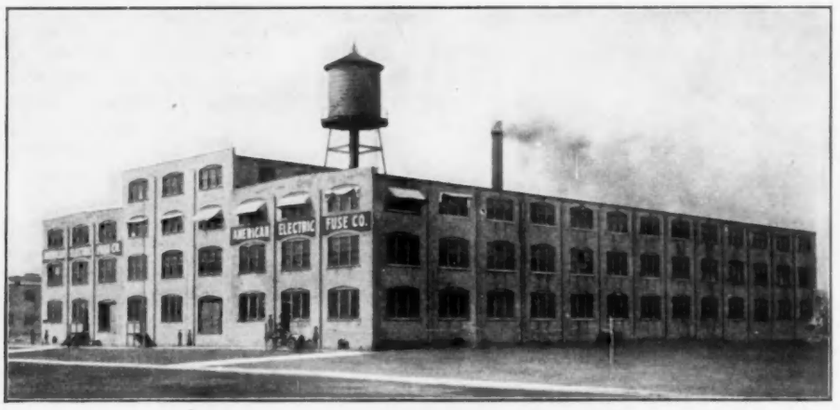
It seems an appropriate time to point out that a properly designed telephone dispatching equipment will practically eliminate the possibility of such accidents. As a type of such equipment, we can do no better than call attention to the system furnished by the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. A general description of the operation of this apparatus is given in the article "Interurban Railway Dispatching" on another page.

It is interesting that coincident with the news of the Indiana accident referred to, the Stromberg-Carlson Company received an order to equip the entire system of the Stark Electric Railway of Alliance, Ohio, with S.-C. dispatcher's signals, and the work of installing will be pushed to early completion. Evidently this railway has no desire for the kind of newspaper publicity which comes from misfortune.

Of Interest to the Trade

American Magnet Wire

COTTON and silk thread, being very low in the scale of conductors and easy to apply to copper wire, came early into almost universal use as insulating materials for low voltages and for a long time held the field, though admitted to be far from perfect. Engineers were busy with high tension windings. If an electromagnet or solenoid was needed the engineer designed one and made it, paying little attention to any phase of any problem but his own particular one.



American Electric Fuse Company's Factory at Muskegon.

Within a few years engineers have turned their attention to coil windings with the result that laws have been developed and details concerning them worked out very thoroughly. The basic principles on which the laws of magnet windings were founded had long been understood, but little practical use had been made of this knowledge. It was known that there were fixed relations between the number of turns of wire, the size of the wire, the resistance of the winding, the current consumption and the work to be performed, and that this relation varied with the thickness of the insulation.

Chief Engineer C. R. Underhill's Office and Laboratory.

As soon as these principles began really to interest engineers, and the laws and tabulations based upon these principles were published, there arose an insistent demand for some other insulating material. The fabric-covered wire was too far from the ideal insulation entirely to satisfy up-to-date engineers.

Inventors and experimenters in industrial chemistry began to busy themselves. The ideal insulation must occupy less space than a single thickness of silk thread; it must be able to insulate and carry high tension currents safely; it must withstand heat, be impervious to moisture, and inert to chemical action.

A recital of all the experiments and discoveries and failures attending this search for an ideal insulator would be interesting, but probably unprofitable. The American Electric Fuse Company of Muskegon, Mich., solved the problem of successfully coating copper wire with an elastic enamel which possessed very high dielectric qualities.

A GOOD DIELECTRIC.

This American enamel was subjected to many tests. It was found that it required an average pressure of 736 volts to break through the enamel insulation on a three-foot length of No. 36 wire, whereas only 587 volts is needed to break through single cotton, and 527 volts to break through single silk insulation.

Testing Coils with Special Instrument.

In the second place an insulation had been perfected which occupied much less space than any insulation previously used or known. The accompanying table shows the wonderful saving in space effected by the use of enamel insulation in the cases of a few standard guage magnet wires:

WIRE B. & S. Gauge	APPROXIMATE FEET PER POUND Single Cotton	Single Silk	Enamel	Barre Wire
24	763	799	810	818
27	1500	1584	1620	1639
30	2860	3148	3240	3287
32	4234	4913	5132	5227
35	7755	9536	10197	10480
40	18376	26558	32107	33410

An examination of the above table reveals a remarkably close approximation of enamel insulated wire to bare wire and a correspondingly great deviation between bare wire and silk or cotton insulated wire, especially in the sizes ordinarily used in coil windings.

ENAMEL INSULATION WITHSTANDS HEAT FROM WITHOUT.

A requisite of an ideal insulator is that it should be able to withstand high temperatures without impairment of its dielectric properties. American Enamel is tested up to 600 degrees Fahrenheit. In actual service it has been subjected to much higher temperature without injury.

Enamel insulation is not only unaffected by extraordinary temperatures, but it readily dissipates heat caused by abnormal currents in the coil. The enamel coating is non-porous and therefore non-hygroscopic. A coil wound with enameled wire may be submerged in water without developing a short circuit. Its insulation will resist without injury the action of any ordinary chemical solution with which it is likely to be brought in contact. It is insoluble in organic liquids, dilute acids, alkalies, etc.

With all these qualities this enamel coating is tough, adhesive and pliable. It will resist ordinary rough usage and under ordinary conditions will not crack, scale or peel off. It will stretch with the wire and the wire can be bent or twisted without injuring the insulation.

The mechanical equipment required to apply this enamel to the wires evenly and smoothly, is both complicated and expensive. It must be as nearly as

A Stock of Bare Wire.

The Coil Winding Room.

Rewinding and Inspecting Department.

possible automatic in order to eliminate irregularities that otherwise would be unavoidable.

A trained force of operators is also a prime necessity. Working under extraordinary atmospheric conditions and continually under mental tension, good men can he held only through the expedient of high wages and short hours.

Having perfected enamel magnet wire and brought it into general use, the American Electric Fuse Company found itself immediately called upon from many different quarters to design coil windings for particular required duties. These requirements ranged from windings for wireless telegraph outfits specifying a certain length of spark to a mechanism for operating fog whistles on ocean steamers. Each coil user had a different problem requiring different calculations, different sizes of wire, different styles of winding; in fact there were no reliable standards whatever.

The first requirement was for an engineer corps, competent to calculate the windings needed to perform the required work, and to fix certain standard specifications under which coils for particular purposes could be wound accurately, uniformly, and with a positive assurance that they would perform the duty required of them. As the head of this department, Mr. C. R. Underhill, the well-known New York coil engineer, was secured.

Good equipment was the next requirement. The chief engineer condemned machinery without mercy whenever he could secure or design a machine that would wind coils more accurately and more rapidly. The result is a battery of highly efficient, practically automatic coil winders. Furthermore, the machine-made coils are much more uniform and much neater in appearance than work done by hand. American enameled wire is used in all windings.

Coil problems are primarily merely a matter of calculation. Given high grade materials, accurate machines and intelligent workmen, a coil winding is simply a matter of mathematics. But an error of a decimal point in calculation can easily change a thousand carefully wound, well-made coils into useless scrap. This contingency is avoided by employing technical men who are able to "do complicated stunts" in higher mathematics.

Still, an error may sometimes slip through, or a fine wire may break during the winding process and an imperfect coil may find its way in among the perfect ones. But it can go just so far. Every coil must undergo a final test.

For these tests the ordinary instruments proved too slow and too difficult to read. Then, too, they were not calibrated closely enough for the purpose, nor did they provide against variation in temperature. It was necessary, therefore, to build special instruments with the result that the windings can be tested quickly and accurately, and the instrument shows to a fraction of an ohm exactly how much resistance the coil contains. Variations in temperature are taken into account. The dial shows at a glance the percentage of resistance above or below the required amount. A novice, after two minutes instructions, can use the instrument as accurately as an expert.

Telephone Engineer acknowledges its indebtedness for most of the material in this article to the booklet "Enameled Magnet Wire and Electromagnetic Windings," published by the American Electric Fuse Company as Bulletin No. 350. This book should be of great interest to coil users. It can be secured free from the company.

Kellogg Gets Raleigh Contract.

The Kellogg Switchboard and Supply Company announces that it has closed a contract for complete switchboard equipment for the Raleigh Telephone Company, Raleigh, N. C. There is to be a new standard type switchboard consisting of two sections, each having a capacity for 3,000 multiple jacks. The two sections are equipped with 700 common battery lines installed in five regular positions, with full multiple installed every four panels and twenty magneto lines installed in the first position next to the box panel.

Each of the regular positions is equipped with 15 common battery cord circuits, each pair of cords having an individual four-party ringing key. The farmer's position is equipped with 10 combination toll to toll and toll and to local cord circuits.

The Kellogg Company also furnishes the necessary main distributing frame and relay rack. The telephone company will use the present power equipment.

The switchboard has some special patented operating features in it which were furnished at the special request of the manager, Mr. W. A. Wynne. The system is so wired that when any subscriber removes his receiver from the hook, he will be immediately connected with the operator who will receive the request for the subscriber desired and plug in with the calling cord and ring the desired party before inserting the answering plug, thus giving quicker service. If, however, another call should come in before she completes the first call, the operator can prevent the second calling party from interfering by plugging into the answering jack with the answering cord in the usual manner.

A subscriber often desires to call several parties in rotation and the cord circuits have a special feature for this arrangement; after conversation has been completed all the calling party has to do to be able again to speak directly to the operator is to operate his switch hook once. He will then be able to tell the operator what party he desires next and this without the operator having to throw her listening key.

This arrangement has already been used in this system for several years with great satisfaction to the subscribers.

While the Kellogg Company emphasizes the importance of standard equipment, it is anxious to cooperate with customers in the installing of equipment especially suited to individual needs and offers experience and factory facilities for the building and installing of special service equipment.

Klein & Sons Busy.

Mathias Klein & Sons, manufacturers of linemen's and electricians' tools, report that they are busy in both their old factory on Van Buren street, and at the new factory on Clybourn avenue. The Van Buren factory is now almost exclusively employed in the production of Klein pliers of various styles and sizes, side cutting, long nose, oblique cutting, flat nose, weaver nose, burner pliers and gas pliers, for which there is an ever increasing demand. The Clybourn factory is employed in the production of the various items comprised in the general line of the firm's products. They advise that they will send their catalog to all responsible parties, and should be addressed at Station U, 20, Chicago, Ill.

Comparative Test of Telephone Dry Batteries

The telephone without its power plant is like the trolley car when the pole is off the wire. Without some means of supplying electrical energy it is practically a useless thing. With a central battery system a storage battery equipment is invariably used. With a magneto system the energy for transmission and ringing is generally supplied by groups of dry cells.

The importance of dry batteries for use with the local battery telephones cannot be overestimated. It must be apparent even to the uninitiated in telephone matters that the character of telephone service where dry cells are used depends to a very large extent upon these suppliers of electrical energy.

But this is not all. A great many telephone companies find that the cost of installing new dry batteries exceeds their first cost. The factor of revenue to the operating company is an important one in a discussion of the question of efficiency of telephone dry batteries.

The service given in telephone work by dry cells is not identical with other sorts of services which dry cells are called upon to perform. It has been recognized for some time by the leading manufacturers that dry batteries for telephone work need to be especially designed for the task which they will be called upon to perform.

Manufacturing companies take extreme care to test properly every piece of apparatus and every raw product entering into the construction of their manufactured product. An illustration of this point is the comparative test of telephone dry batteries carried on in the laboratories of the Western Electric Company.

In this connection it is interesting to note that no less than three and one-half million "Blue Bell" dry cells are sold by this company each year. This volume

Fig. 1. Western Electric Dry Battery Testing Cabinet.

of business, in a large measure, explains why the Western Electric engineers are anxious to obtain data which will tell conclusively just how the "Blue Bell" battery, designed and manufactured especially for telephone service, measures up to the efficiency standards which will be required of it in the important services it will be called upon to render.

Samples of a number of leading types of dry batteries are secured, and together with "Blue Bell" batteries are placed in the testing cabinet shown in the illustrations. In this way, through the medium of the apparatus connected with this testing cabinet, statistics are secured which tell the story of the comparative efficiency of the "Blue Bell" and the other types of batteries which have been chosen to undergo the exacting tests.

Fig. 2. Ammeter, Clocks and Contact Mechanism.

In order to test accurately the value of dry cells for telephone work it is necessary to duplicate as closely as possible conditions of actual service. The batteries under observation in the testing cabinet must be undergoing the same drain that they would experience in use with subscribers' sets on a regular telephone circuit.

This cabinet contains apparatus for closing circuits through the medium of which conditions on telephone circuits are paralleled to a remarkably accurate degree. The tests have been in progress for some time in the physical laboratory of the company's New York plant and cover most of the prominent makes of dry batteries manufactured in this country as well as one or two foreign cells, the operation of the different types being compared.

To the left of the illustration marked Fig. 1 are seen compartments smaller and grouped together more closely than those to the right. This division marks the distinction between the two tests, one of which is conducted on dry cells duplicating subscriber station service conditions, the other on cells used in connection with pole changers for ringing purposes. Each of these tests is distinct from the other, requiring special and separate apparatus.

By means of an automatic timing device the batteries while being tested are discharged in a manner similar to what has been found in actual telephone use. In case at any time this clock gets out of order or stops, contact by means of a mercury cup underneath the pendulum will cause the automatic switching in of another clock, shown on the right of the cabinet in Fig. 2.

A set of tests of each type of battery under investigation is started once a month. Each test includes fifteen cells in five groups of three cells each. In addition, fifteen cells of each type are procured every four months, and after having been kept on the shelf for four months without being subject to any drain are placed upon the service test in the manner

already described. As many as ten types of cells have undergone test at one time.

On the right of Fig. 3 are shown a number of interrupters used with the second group of cells in the test for ringing current. These tests are made so as to reproduce average pole changer conditions. Two groups of cells of each type are used steadily for ten hours a day. One group rests while the other is discharging. The ringing side of the interrupter is connected to an artificial line through which the ringing current discharges.

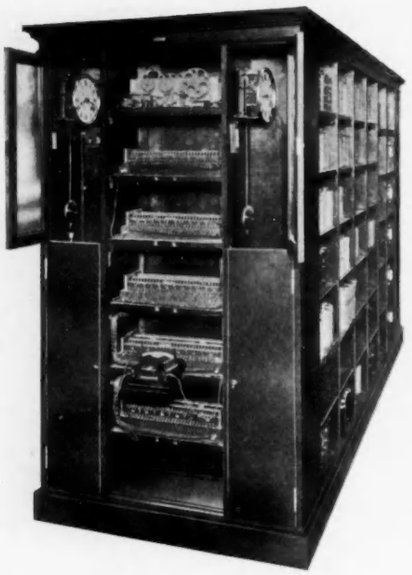


Fig. 3. Other End of Testing Cabinet.

Readings of the current drain are taking on each test every Tuesday and Saturday at the end of the tenth closure by connecting an ammeter in the battery circuit. The ordinary telephone battery "cut-off point" determines the taking of data.

In every case the current drain duplicates average conditions of actual telephone service and the test is a reliable and accurate one of the comparative efficiency of dry batteries for telephone uses.

Foreign Trade Opportunities.

An American consular officer in a European country reports that during the past year a local municipality installed a public telephone system, the same having a capacity of 600 instruments. The city now intends to extend the central station and the overhead and underground wiring in order to increase the capacity to 1,200 instruments ,and the contract will amount to about $25,000 to $30,000. The city council is not very well satisfied with the working of the present European system, and desires to become acquainted with the latest American systems, and with that end in view requested to be placed in touch with manufacturers in the United States. The council is desirous of receiving not only catalogues and price lists, but also all possible detailed information and specifications. When forwarding the above information it would be well to address one set to the mayor of the city in question and a duplicate to the consulate transmitting the report. Correspondence may be in English. The name and address will be given upon application to TELEPHONE ENGINEER, or to the Bureau of Manufactures, Department of Commerce and Labor, Washington, D. C. Refer to file No. 4829.

An American consul in Latin America reports that a state telephone bill is now under consideration by the local government, several experts having appeared to give testimony. He states it is considered a foregone conclusion that such a bill will become law in the near future, when an opportunity will be presented for American contractors to offer bids for the construction of this important work. They should form business connections with men in that country so as to successfully meet competitors. The name and address will be given upon application to TELEPHONE ENGINEER, or to the Bureau of Manufactures, Department of Commerce and Labor, Washington, D. C. Refer to file No. 4916.

In answer to an inquiry from the United States, an American consul in China reports that a city with a population of about 55,000 has no telephone service. There are also a number of smaller places within a radius of 25 miles, also two cities of considerable importance which could easily be reached by outside lines. The consul thinks it doubtful if a concession could be secured, but forwards the name of the electric light company in that city which might be interested in the introduction of a telephone service. The name and address will be given upon application to TELEPHONE ENGINEER, or to the Bureau of Manufactures, Department of Commerce and Labor, Washington, D. C. Refer to file No. 5476.

A report from an American consul in Mexico states that the local telephone company is changing hands and the new company, represented by an individual whose name is given, will need quite a lot of new fixtures, as it has secured a concession to connect all the principal places throughout the state. The name and address will be given upon application to TELEPHONE ENGINEER, or to the Burear of Manufactures, Department of Commerce and Labor, Washington, D. C. Refer to file No. 5278.

Kellogg Bulletin Issued.

The Kellogg Switchboard and Supply Company has just issued a folder describing the Kellogg direct harmonic system for magneto exchanges. Some of the advantages of the system are:

Four telephones can be operated selectively on a metallic circuit with no grounds at subscriber's station or at central office.

Four telephones can be operated selectively on a one-wire grounded (or common return) line.

Eight telephones can be operated selectively on a full metallic circuit by bridging four bells from each side of line to ground.

Subscriber calls central and "rings off" without disturbing any bells on the line. Neither can any bell on the selective line be disturbed by a ring coming from any connected line.

The company has also issued new folders on its popular types of lineman's test sets and the Kellogg malleable iron pole telephone. The worth of this special service telephone is shown by the fact that many of the largest railroads are using it in large numbers.

These booklets will be sent promptly on request to the company.

Mr. R. C. Coyne of the Kellogg Switchboard and Supply Company will take charge of the Wisconsin territory beginning September. Mr. Coyne has many friends in this section, having traveled the state frequently in the past two years. He is an enthusiastic telephone man with a thorough practical knowledge of the Kellogg line and will devote his entire time to the services of Kellogg customers and friends. His headquarters for the present will be at Delavan.

The Stromberg-Carlson Plant Two Years Ago.

The Stromberg-Carlson Plant.

In July, 1908, the Stromberg-Carlson Telephone Manufacturing Company sent to its friends in the trade a series of post cards, illustrating the various buildings of its big factory and offices at Rochester, N. Y. Today it is sending out another long, folded card which conveys a very good idea of the big plant's present appearance, as viewed from an elevation of sixty-five feet.

We are showing, on this page, both illustrations—the plant as it was two years ago, and as it is today, viewed from approximately the same point of the compass. Both views show the large area covered by the well-lighted and well-ventilated buildings of the plant, and at first glance, perhaps, there seems to be little difference between them. But a closer examination cannot fail to reveal marked improvements and changes in the general appearance and surroundings.

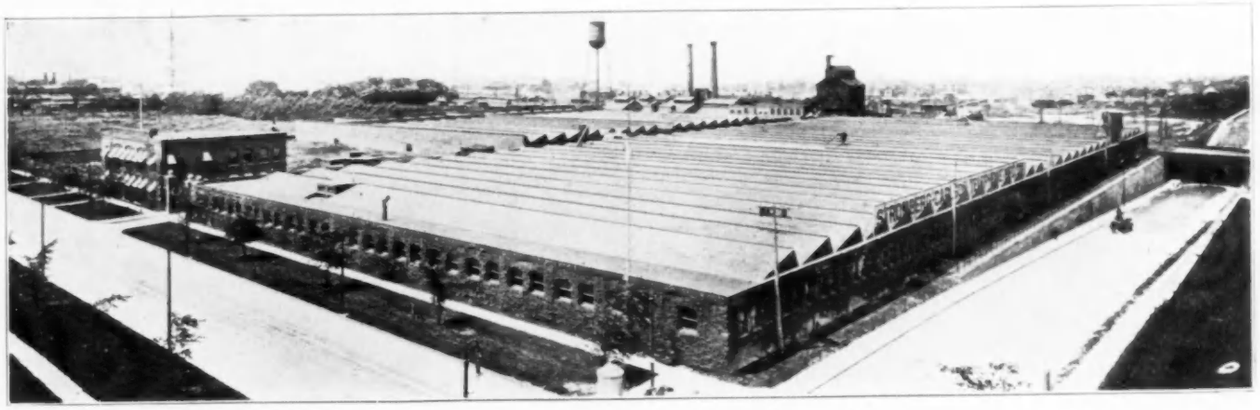
Those who have visited our eastern cities—which term, to a Chicagoan, means any place east of Buffalo—are familiar with the great screens of cool-looking ivy which cover brick and stone walls like a green mask. Observe how the sides of the Stromberg-Carlson plant are covered with it, from foundation to roof, only the bare rectangular spaces showing where windows and doors are located. It is not so, however, in the earlier picture; then the little ivy tendrils were only beginning to get a foothold in the crevices between the particles of brick and mortar. This is one of the things that time will do for improvements started by man.

When the first picture was taken the street to the right of the plant was not paved. Now it not only has a surface that would invite any automobilist, but it is provided with a subway where it passes under the railway tracks at the back of the picture.

Time has evidently favored the physical aspect of the Stromberg-Carlson plant. Its restful, contemplative look forms a striking contrast to the intense commercial activity within its walls.

Mention of these companion pictures would be incomplete without some comment on the well kept lawns and trees, which go so far toward rendering attractive even so commercial and seemingly sordid a proposition as a factory plant. We must remember that within these walls some hundreds of employees spend the best part of their waking hours. That so much has been done to cast their lots in pleasant places must be placed to the credit of the company. Those who are happy in their work are indeed happy and the Stromberg-Carlson Company seems to appreciate it.

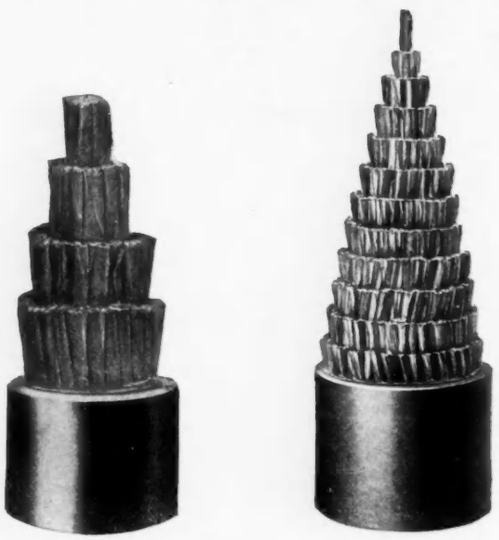
The Great Northern Railway Company has had a crew of men at work in Minnesota installing a modern telephone system from Melrose to Barnesville. The wires are strung to within a short distance of Sauk Center and will be strung to Fergus Falls in a short time. When the Fergus Falls system is completed the trains will then be dispatched by telephone on that division. On the Wilmar branch the telephone has worked so successfully that it will be tried on the whole system of the main line to Seattle.



"Sky View" of the Stromberg-Carlson Plant as it Appears Today.

Lead Covered Telephone Cable.

In the summer following the disastrous sleet storms of February, 1909, many telephone companies installed lead covered telephone cable. During the summer just ended a great many more, seeing the advantages of cable construction, have replaced a large amount of their open wire lines with lead covered cable. Present indications



60 Pair Cable. 600 Pair Cable.

are that each year more telephone companies will insure their lines against destruction and their stockholders against unnecessary hazard. Of course, it is not probable that cable will entirely replace open wire construction, for under certain conditions it is still practicable and advisable to install open wire.

Where the number of lines is twenty, or more, two-wire circuits, it seems no longer advisable to use open wire construction. As the number of lines increase difficulties are encountered; the poles are overburdened by the addition of cross-arms, lines continually become crossed, and the wires, arms and even the poles are unable to withstand the ravages of the winter storms.

In order to have sufficient strength to withstand all ordinary weather conditions copper wire must be of such size as to make it extremely expensive. Iron wire is not desirable for many localities, such as the gas laden air of cities or the salty air of the coast sections, because of its susceptibility to chemical action.

The maintenance expense of any open wire line, whether of copper or iron, is high, and in regions where sleet storms are not uncommon some sort of wire protection is imperative. For this protection the dry core type of lead covered cable is most commonly used. This cable may be strung on poles in the usual way or it may be laid underground. The former method is chiefly employed in towns and in the smaller cities. In large cities the underground method is preferable, as poles and wires are unsightly and dangerous.

Since the use of lead covered cable means besides protection a reduction in maintenance expense, a saving in poles, cross-arms and wire, increased revenue, better service and satisfied customers, it is no wonder that the telephone companies are rapidly adopting it.

Some indication of the popularity of the dry core type of lead covered cable is the amount of this cable sold annually. The Western Electric Company has a special cable plant devoted to its manufacture. The output of this plant for 1910 has been at the rate of 200,000,000 conductor feet of lead covered cable per week. During 1911 the output will be increased to 250,000,000 conductor feet per week. This cable ranges in size from 5 to 600 pair, and practically all of it is single paper insulation, very little double paper insulated cable now being required. Two hundred and fifty million conductor feet is equivalent to 7,500 carloads of lead covered cable during the year. The manufacture of this large amount of cable requires almost 200,000,000 pounds of copper, lead, tin and paper in a plant utilizing over 160,000 square feet of floor space.

A Sledge and a Man to Swing It.

In these days of hurry and hustle, the time and labor saver, other qualities being equal, is first choice in all lines of industry. Thus a guy anchor that can be installed by one man in ten minutes is preferred to another that requires the services of two men for a longer period of time.

This remarkably short time of ten minutes is claimed by the Crouse-Hinds Company as the average for sinking and setting its harpoon guy anchor. It is further claimed that the "Harpoon" can be installed quickly where intertwining roots, buried timber or other obstructions are found.

All parts of the harpoon guy anchor are made of steel, three sections being used as each proved itself best adapted for the particular purpose. The point of the rod is hardened and, without injury to itself, will chip off

The Harpoon Guy Anchor, Closed and Open.

or turn aside such large stones as may be in the course of the anchor's path.

"A sledge and a man to swing it" is the catch phrase of the manufacturer in declaring the full requirement for driving the "Harpoon," and an upward pull, such as could be given by the tightening of the guy wire, sets it.

This pull causes the four wings to open out in undisturbed ground.

That the anchorage thus secured is ample for all pole line purposes would seem to be proven by tests made in competition, where standard guy wire snapped and come-alongs gave away under strains that failed to materially loosen the "Harpoon's" hold in the ground.

Other advantages detailed by the manufacturer are that this anchor can be located in a hedge, against a curb or anywhere that space permits the entrance of the point and closed wings. Moreover, as there are no loose parts to get lost and no special tools required, installations can begin at once and proceed without interruption as soon as the crew arrives on the ground.

The speed with which this anchor can be installed and the fact that the operation does not require the tearing up of the surrounding soil, suggest that it is peculiarly suited for use where "stealing" is necessary.

A handsome catalogue containing full data regarding the harpoon guy anchor and numerous illustrated solutions of troublesome anchorage problems, can be secured free by writing to the Crouse-Hinds Company, Syracuse, N. Y.

Another Automanual Installation.

The Decatur County Independent Telephone Company, Greensburg, Ind., having outgrown its present capacity, recently decided to purchase entire new equipment and appointed a committee of four to make a thorough investigation of the various types of most modern and up-to-date telephone apparatus.

This committee visited among other places the city of Ashtabula, Ohio, and inspected the automanual exchange at Ashtabula Harbor, installed by the North Electric Company early in 1909, and after a careful examination and study of this system they returned to their home in Greensburg and submitted a full report to their company.

The advantages of automanual set forth in this report were so marked and so seemingly impossible, that it was decided to send a second committee to Ashtabula for the purpose of confirming the report of the first committee. As a result of the second committees' visit, the North Electric Company, Cleveland, Ohio, has been awarded a contract for 800 lines of automanual to be installed in Greensburg, Ind.

The Greensburg people have closed negotiations for new central office quarters and when their new equipment is installed they will have one of the most modern exchanges in the state of Indiana.

Automanual and Telechronometer Combine

Announcement has been made of the consolidation of the Telechronometer Company, Rochester, N. Y., and the North Electric Company, Cleveland, Ohio. The Telechronometer Company controls both the telechronometer, a meter for the measurement of time use of the telephone and the automatic telephone message meter; while the North Electric Company, besides controlling patents and manufacturing general telephone equipment, controls the so-called "automanual telephone switchboard."

The new company, which is incorporated under the laws of the state of New York, will be known as the Telephone Improvement Company.

The importance of this announcement is increased by the fact that the Telechronometer Company is controlled by Hon. Frederick C. Stevens, former senator and at present superintendent of public works of the state of New York, and it is understood that Senator Stevens will not only be president of the new corporation, but that he will be active in the direction of its affairs.

Associated with Senator Stevens in the management and direction of affairs of the new corporation, will be engineers and others of distinction in the telephone field.

Senator Stevens states that the company is not yet ready to give details as to plans of its activities, but very shortly official announcement will likely be made as to such plans. It is understood that the study which he has made of the general subject of telephone service has been the strong inducement for his entering the telephone manufacturing field. That a thorough regulation of telephone service is bound to come, Senator Stevens believes.

Western Electric Planning Enlargements.

The Western Electric Company has seen no occasion so far to revise the estimate of a gross business for the year of $61,000,000, which was made last February. The gains which the company has recorded consistently in the current year, continue. August showed an increase in business equal to a gain of 50 per cent over the corresponding month in 1909, as did last July over the preceding July.

The probable showing of $61,000,000 for the present year is exceeded only by 1906, with gross sales of somewhat more than $69,000,000. It is of interest to note that the nature of the company's business has changed markedly in three years. In the latter part of 1907 the Western Electric Company broadened its policy with the result that instead of being confined to the twenty-five associated Bell companies, its business is distributed among more than 7,000 telephone companies, as well as many thousands of customers for electrical supplies and apparatus. In 1906 and prior thereto, a large part of the Western Electric's business was with large telephone exchanges. The trend of the business at the present time is best shown by the fact that in the last twenty months more than a quarter of a million of rural telephones have been distributed.

This year's business will be divided among approximately 800,000 orders as compared with 475,000 in 1906, with an average value per order of $71 for 1910, as compared with average value of $145 per order in 1906. In other words, more than twice the number of orders had to be handled for the same amount of business. The business is coming from all sections of the country, indeed from all parts of the world. Export business is showing gratifying increases. There is a constantly growing demand for the various lines of merchandise handled by the company in addition to those already mentioned.

On the Western Electric's pay roll there are at present 23,000 persons.

Indiana Steel Busy.

The Indiana Steel and Wire Company's mill has resumed operation in all departments after having been closed for three weeks undergoing extensive repairs. The company has added about $75,000 worth of improvements, consisting of a steam turbine and generator, new bakers, and annealing ovens, with the addition of much new machinery. The plant has been thoroughly overhauled and it is now in the best shape for turning out high grade

wire that it has ever been. The company has already achieved an enviable reputation in the trade as a manufacturer of wire of extra high quality.

The wire has found friends in all sections of the country and is now universally used and endorsed by the representative concerns and jobbing houses. Wire fence the past year showed a slight increase, which the company considers exceptionally good since many manufacturers' business has not been up to its usual standing. This increased business can only be attributed to the quality of the wire.

Ohio Morgan Companies Examined

A complete examination of all the Morgan Ohio companies has now been made, both in respect to their physical condition as well as their earning capacity and financial situation, and it is expected that within a short time some announcement will be made regarding the future of the companies. The audit is said to show that there is a large earning capacity in all the companies, but that large sums will have to be spent to bring them up to a condition where results can be obtained.

The Columbus, the Toledo and the Cleveland companies are in good physical condition and need only financing for extensions, so that they can go out after business. The Dayton company, as well as the Washington, C. H., the London and the subsidiary companies of the United States Telephone Company and also the latter company will require large expenditures to bring them to the level of the other companies in physical excellence.

Men who are well acquainted with the companies say that there is no doubt that as soon as the reports of the experts have been gone over and estimates made, that the money to make the betterments will be forthcoming, as the Morgan firm will want to get as much as possible out of the properties. It is said that a new company will be formed which will take over all the Morgan telephone properties in Ohio, and that a large bond issue will be made by this company, which will furnish the money to place all the plants in first-class condition.

A. G. Bell Inspects Australian System

"Your telephone service here is the cheapest in the world. I am amazed."

Dr. Alexander Graham Bell, inventor of the telephone, thus expressed himself after he had studied the system at Sydney, N. S. W., Australia. Dr. Bell is in the antipodes for a tour.

He noticed, however, that the telephones are not nearly so much used in the people's homes as in America.

In Indiana, he said, every farmer has one, while there is a telephone in almost every bedroom in the hotels.

The telephone system of Australia is just now in a transition state. The service has been so cheap that the government has been losing money by it. The new postmaster general has just given instructions that on October 1, the present system is to be supplanted by the universal call or flat rate system, which is expected utterly to disorganize existing arrangements, and is believed to be quite contrary to the views of the royal commission, which is just about to present its report, recommending, it is understood, the toll or measured service system.

Paris Conference Discusses Washington Cable

At the first meeting in Paris of the International Telegraph and Telephone Conference for 1910, J. J. Carty, chief engineer of the American Telephone and Telegraph Company, presented a paper giving particulars of an underground cable soon to be laid between New York and Washington, which will be used for telephone and telegraph service. It was stated that the cable will later be extended from New York to Boston and that with the system of operation to be used three telephone conversations will be possible over each of the cable circuits at once without interference of any kind, and simultaneously six independent telegraph messages may be sent without interference with each other or with the telephone conversations. This system, it was added, will be applied to the overhead telephone circuits between Chicago and New York.

Clay Product in Underground Work.

Readers of the article on another page entitled "Modern Underground Construction" will be interested to know that the company mentioned therein is the Clay Product Company, Chicago. This company appears to have established quite a reputation for long distance shipments of clay conduit, having shipped during the past year 268 cars to Pacific coast points, 109 cars to Texas points, and 71 cars into Canada.

The company has accumulated a large amount of valuable data on underground construction costs, which it offers to supply for the use of interested parties.

A Correction

In an editorial on "The Correction of Incivility," on page 99 of Telephone Engineer for September, a rather amusing typographical error appeared in the twenty-second line, second column. As it reads, the telephone company is made to advocate private branch exchange operators answering with their "first" names. Of course, it should have read "firms'" names.

"Party Line Telephones" is the title of the Kellogg Switchboard and Supply Company's bulletin No. 54. It contains 60 pages of very readable matter on the subject of small and medium exchange equipment. The treatment is simple, almost elementary, and suitable for non-technical managers of exchanges.

The Evershed megger, described in the article, "High-Resistance Measurements," by Arthur J. Rowland, is handled in this country by James G. Biddle, Philadelphia, who will be glad to give interested readers any information desired concerning it.

Paragon Bulletin No. 1, issued by the Paragon Sellers Company, contains some new facts about grounding, especially with reference to the use of the Paragon ground cone. It is interesting and well illustrated.

Magneto telephone desk sets, series and bridging, form the subject of a folder recently issued by the L. M. Ericsson Company, Buffalo, N. Y.

Brevities of the Business

PERSONAL NOTES.

Albert Spies, engineer, author and editor, died suddenly at his home, 40 Glenwood avenue, Jersey City, N. J., on August 16, 1910. At the time of his death Mr. Spies was proprietor and editor of the newly established Foundry News. Mr. Spies was born in New York, July 20, 1862. In 1881 he graduated from Stevens Institute and was in engineering practice and technical journalism until 1893, when he became editor of *Cassier's Magazine*. In February, 1907, he assumed the editorial conduct of the *Electrical Record*, continuing until February of this year, when he resigned to bring out his own paper, *Foundry News*. He was a prominent electrical engineer, member of the American Institute; and as a man, was admired and loved by all his associates.

Mr. J. G. Ihmsen, secretary, assistant treasurer and general manager of the American Electric Telephone Company, Chicago, has tendered his resignation, which took effect September 1, 1910. Mr. Ihmsen had been contemplating this step for some time in order to give his entire attention to personal interests, which have grown to considerable proportions. Mr. Ihmsen has long been prominent in the telephone field, having held the position of president of the Independent Telephone Manufacturers' Association ever since its inception.

D. D. Raley, general manager of the Columbiana County (Ohio) Telephone Company, recently announced a few changes in positions made possible by the resignation of J. C. Colton, manager of the East Liverpool Exchange, who has accepted a position in Baltimore. Mr. Colton's successor will be D. A. Taylor, at present wire chief of the Salem plant. P. G. Riehl, trouble man of Lisbon will succeed Mr. Taylor and Mr. Riehl's successor will be G. C. Hall, of Canton.

John T. Gross, of Stockton, Cal., has been shifted to Fresno, where he will become district commercial superintendent of the Fresno district. The new office which Mr. Gross will fill constitutes an enlargement of the force incident to making this district one of the largest in this division of the telephone company, including California, Arizona, Nevada, Oregon and Washington. District Commercial Manager H. B. Patterson will remain in Fresno, it is reported. Mr. Gross, who will have supervision of the district here, has held a similar position in Stockton. His being placed in Fresno, it is reported, is in the nature of a promotion.

Harry C. Brownlee, formerly manager of the Berkeley and Alameda branches of the Pacific Telephone Company, and recently manager of the San Jose district, has taken charge of the Oakdale office of the company. Brownlee, who has been in the telephone service for over ten years, is an expert in his work, and under his jurisdiction several improvements are planned in the service. He will have charge of the annexed districts and the Elmhurst Telephone Exchange as well as of the downtown portion. Thomas De Leury, who has been in Oakland for some time, will act in future as district superintendent, his promotion to this position bringing Brownlee to the city. De Leury will have charge of the exchanges in Napa, Colano, Contra Costa, Santa Cruz, Monterey, Santa Clara and San Benito counties.

Henry P. Thomas, of Atlanta, Ga., has been appointed special agent to the general superintendent of traffic of the American Telephone & Telegraph Company, with headquarters in New York City. In his new position Mr. Thomas will have general supervision of field traffic work for his company throughout the country. G. A. Watson, of Philadelphia, has been appointed division superintendent of traffic, with headquarters in Atlanta, to succeed Mr. Thomas.

Fred Lambert, district superintendent of the Nebraska Telephone Company with headquarters at Hastings, has been transferred to Grand Island and will have a larger territory in northwestern Nebraska north of the Platte.

Charles P. Corning, who has had charge of the Chicago Heights Exchange of the Chicago Telephone Company for the last nine years, has been transferred to the Oak Park Exchange. He is succeeded by J. W. Wylie, who comes from the Hinsdale-Downer's Grove district.

L. D. McLean, formerly general commercial superintendent of the Southwest Telegraph and Telephone Company with headquarters in Dallas, Tex., is now commercial superintendent of the Interstate Consolidated, State Telephone & Telegraph Company and other Thaddeus S. Lane properties. Mr. McLean's headquarters are now at Butte, Mont.

Mr. H. W. Dedrick, former manager of the Central Union Telephone Company Exchange at Portsmouth, Ohio, and later with the Standard Telephone Manufacturing Company, has resigned his position with the latter company and gone to Huntington, W. Va., to locate. Mr. Dedrick has secured a good position with the Southern Bell Telephone Company, and for the present will be located at Huntington.

David S. Murray, former general manager of the Rocky Mountain Bell Telephone Company, committed suicide at Salt Lake City, early in September.

C. E. Miller of Willard, Ill., and W. W. Willbourn, of Olive Branch, Ill., now hold nearly the entire stock in the telephone lines of the county and are extending them to reach all parts of the county. They have two lines running into Cairo, where they connect with the Bell Company. Mr. Wilbourn is president and Mr. Miller is secretary of the two companies, the Thebes & Cairo Telephone Company, and the Diswood Independent Telephone Company.

M. F. Thomas, division superintendent of the Southwestern Telegraph & Telephone Company of San Antonio, has been promoted to be special agent of the company with headquarters in Dallas. His territory will include Texas and Arkansas. Mr. Thomas has been connected with the company in San Antonio many years. When he took charge the exchange had only 604 subscribers. It now has nearly 6,000. The new building of the company is being erected on the site where Mr. Thomas' home was for sixteen years.

E. L. Clark, president of the Valentine-Clark Company, recently took an eight weeks' trip through Idaho, to establish new yards for the company's western cedar poles. The yards are located at St. Maries, Idaho, on the St. Joe river. Unexcelled shipping facilities and all other modern conveniences for handling poles are at the disposal of the company. Mr. Clark and his family lived six weeks on a house boat on the St. Joe river, and were close to the tremendous fires which lasted five days and devastated so much property.

J. A. Murray has purchased a third interest in the Prairie du Chien telephone plant at Baraboo, Wis., and removes to that city about the first of October to take the management.

A number of changes became effective recently in the Paris, Ky., forces of the East Tennessee Telephone Company. Prentice Lancaster, collector, becomes cashier in the Bardstown office; Cashier Thomas Goodwin, of the Paris office, is transferred to the Nashville office, where he becomes traveling auditor. He is succeeded here as cashier by A. M. Stanley, of Bardstown. J. J. Veatch, late manager of the local office, takes charge of the Bristol, Tenn., exchange.

William H. Harter, superintendent of construction for the Omaha Bell Telephone company for the last twenty years, died from a surgical operation for blood poisoning September 8 at the home of his parents, Mr. and Mrs. Harvey Harter, 1617 North Twenty-second street. The deceased was 37 years old and had many friends who mourn his loss. The body was taken to Sabetha, Kas., where it was buried. Mr. Harter was injured which necessitated the operation resulting in his death.

E. L. Ivey was transferred from district traffic chief at Pine Bluff, Ark., to Texarkana, effective August 1, 1910. George R. Marvin, who has been connected with the traffic department at Dallas has been appointed district traffic chief at Pine Bluff, succeeding Mr. Ivey.

J. S. Stevens, superintendent of telegraph of the Chesapeake and Ohio Railroad Company, Richmond, Va., has had his jurisdiction extended to include the Chesapeake and Ohio of Indiana.

Division Manager Kalchthaler, of the Michigan State Telephone company, Kalamazoo division, reports that July 1, 1910, Mr. Lowell Johnson succeeded Mr. Archer W. Robb as district manager at Hillsdale, Mich. That also, July 1, 1910, Mr. Archer W. Robb succeeded Mr. Harry P. Storkerson as district manager at Kalamazoo, Mich.

J. J. Forrester has been transferred to Ft. Worth, Tex., from Little Rock, Ark., as district plant chief, vice B. J. Boon resigned.

C. B. Abbott, formerly manager for the Central Union Telephone Company at Mansfield, Ohio, has been appointed manager at Toledo, and J. C. Gibson, former Toledo manager, has been transferred to the directory advertising department.

The New York State Public Service Commission, Second District, has appointed Walter I. Sweet, of Port Richmond, Borough of Richmond, New York, to be assistant chief of the division of telephones and telegraphs at a salary of $3,000 per year, to be in charge of the New York office. Mr. Sweet is 45 years of age and has had extensive experience in telegraph, railroad and telephone service. In 1906 he was district manager of the Jersey City district of the New York & New Jersey Telephone Company and two years later upon the merger of the functional and territorial organization with the New York Telephone Company became local agent in charge of the commercial department of the company and was the senior officer of the company in that district.

IN THE MARKET.

Mt. Sterling, Ky.—The East Tennessee Telephone Company will overhaul and repair its lines in Mt. Sterling necessitating the use of considerable construction material. A new line will be constructed from Mt. Sterling to Stanton, via Clay City. Address, East Tennessee Telephone Company, Mt. Sterling, Ky.

Jamestown, Ky.—The Cumberland County Home Telephone Company is a new company just organized here for the purpose of building a local, independent system in Jamestown and Cumberland and Clinton counties. The main line will be from Jamestown to Clinton, 30 miles connecting an important farming and agricultural community. Complete line of construction material will be needed. Address, The Cumberland County Home Telephone Company, Jamestown, Ky.

Pine Top, Ky.—The Carr's Fork Home Telephone Company announces that it is in the market for a switchboard for the exchange at Hindman. Will also need some construction material as it will build some new lines during the next few months. One line will be built from Pine Top via Bath to Hall, Ky. Address, Carr's Fork Home Telephone Company, Pine Top, Ky.

Pikeville, Ky.—The Eastern Kentucky Home Telephone Company announces that it has acquired franchise for a local, independent telephone line from Pound, W. Va., via Glamorgan and Wise, Va., to Norton, in the southwestern Virginia coal fields where long distance connections will be made with the East Tennessee Telephone Company. A full line of construction material will be needed. Address, N. Starkey, manager, Eastern Kentucky Home Telephone Company, Pikeville, Ky.

Kellogg, Ky.—The Kellogg-Smith Telephone Company is being organized here by G. E. Kellogg, Sam N. Smith and others for the purpose of building and operating a telephone system in Kellogg. Construction of lines will be begun soon. Complete line of construction material will be needed. Address, Kellogg-Smith Telephone Company, Kellogg, Ky.

Colly, Ky.—The Sergent-Ola Telephone Company have elected new officers. Elzy Franklin becomes general manager and John S. Webb at the head of construction work. Some new lines are to be added to the system. One new line will be built from Hilliard to Lester. Construction material will be needed. Address, Sergent-Ola Telephone Company, Colly, Ky.

RATES.

Los Angeles, Cal.—An ordinance was recently passed by the city authorities of Los Angeles fixing telephone rates in that city, which is being contested by both the Pacific Telephone and Telegraph Company and the Sunset Telephone Company. The city has made an appropriation of $15,000 for the purpose of investigating the properties of the two companies thoroughly with a view to determining whether or not the proposed rates are justifiable.

Sauk Center, Minn.—Under its new franchise, recently granted, the Northwestern Telephone Exchange Company increased its rates from $2 and $1 to $2.50 and $1.50 respectively. As a result steps are being taken for the organization of a new company.

Ashtabula, Ohio.—The Ashtabula Telephone Company recently announced an increase of rates, and the city solicitor has asked for an injunction restraining the company from putting the new rates into effect.

FINANCIAL ITEMS.

New Burnside, Ill.—Although only a year and a half old, the Johnson County Telephone Company has increased its capital stock twice, the last increase being from $10,000 to $25,000.

Lowell, Ind.—The capital stock of the Lowell Telephone Company has been increased from $9,000 to $25,000.

Mauckport, Ind.—The Eureka Telephone Company has increased its capital stock from $25,000 to $50,000.

Corbin, Ky.—The capital stock of the Corbin Telephone Company has been increased from $3,000 to $4,000 for the purpose of making extensions and improvements.

Savannah, Mo.—The Andrew County Mutual Telephone Company has under consideration the increase of its capital stock from $15,000 to $20,000 and this will probably be done at its annual meeting, to be held on September 2d.

Red Cloud, Neb.—The state railway commission has granted the Amboy Telephone Company permission to issue $3,000 worth of stock, and a similar privilege has been extended to the Tri-County Telephone Company of North Platte.

Skaneateles, N. Y.—The Skaneateles Telephone Company has decided to increase its capital stock from $14,000 to $20,000.

Kutztown, Pa.—The capital stock of the Kutztown Rural Telephone Company has been increased from $10,000 to $20,000.

Malone, Wis.—An amendment has been filed by the Calumet Telephone Company, increasing its capital stock from $3,500 to $6,000.

Buenos Ayres, S. A.—At the annual meeting of the United River Plate Telephone Company, held in London, the capital stock of the company was increased 1,000,000 pounds to 1,500,000 pounds. The company has 21,000 subscribers in Buenos Ayres, and La Plata.

MISCELLANEOUS.

Whittier, Cal.—Negotiations have been consummated whereby the Home Telephone Companies of Whittier and Downey have been taken over by the Pacific Telephone and Telegraph Company.

San Francisco, Cal.—The Santa Fe Railroad now has 2,275 miles equipped with telephones for train dispatching purposes and has ordered equipment for 460 miles more. Eventually all its trains will be operated by means of the telephone.

Little Rock, Ark.—The Little Rock Telephone Company is making arrangements to install a complete new telephone system.

North Salem, Ind.—Messrs. Deere and Milligan, of Waveland have purchased the Farmers' Mutual Telephone Company at this place.

Linden, Ind.—A new company, composed of Theodore H. Ristine, H. H. Ristine, and J. K. Johnston, directors of the Home Telephone Company, of Crawfordsville, and M. B. Tomlinson and Daniel Harrigan, of Linden, has been incorporated for the purpose of taking over the plant of the Linden Co-operative Telephone Company. The name of the company will remain the same. The new owners will improve the plant, installing a new switchboard and cable.

Oolitic, Ind.—The Social Home Telephone Company of this place has been purchased by Fred F. Bingham, manager of the Bedford Home Telephone Company, who will improve and extend the service.

Fort Wayne, Ind.—The Lake Erie and Western Railroad is equipping its lines in the northern part of the state with telephones for train dispatching.

Las Animas, Colo.—The Colorado Telephone Company will expend $50,000 in improvements during the present year, in addition to the $22,000 that will be spent on its plant in Las Animas, Lamar and Holly. The company will expend $12,000 at Rocky Ford, $12,000 at La Junta and $4,000 at Manzanola and Fowler.

Topeka, Kans.—The Topeka Independent Telephone Company contemplates the expenditure of between $50,000 and $75,000 in improvements and enlarging its conduit system and switchboard capacity.

Crystal Lake, Ill.—The local telephone company has been purchased by the Chicago Telephone Company.

Hammond, Ind.—The growth of the Chicago Telephone Company in this city has been so great that it has been necessary to purchase a site on which to erect an addition to its present plant.

Chicago, Ill.—The American Trust and Savings Bank has been appointed receiver for the Western Telephone Manufacturing Company, 219 South Clinton street.

New Castle, Ind.—The Central Union Telephone Company will erect a new exchange in this city, having outgrown its present facilities. The company contemplates the expenditure of about $50,000 in improvements and extensions.

Colson, Ky.—The Colson Telephone Company, recently organized, will install an exchange at this place.

Fulton, Kans.—The Fulton Mutual Telephone Company was recently reorganized and the following officers elected: President, secretary and treasurer, John E. Hall; vice-president, P. W. Payton; directors, the above officers and Julia Hall, Elizabeth Hall and Claude M. Grigsby.